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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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74-2532. Musgrove, J. (Houston, TX 77034). **DDT.** *Environ. Sci. Technol. 8(7): 595; 1974.*

A Letter-to-the-Editor comments on an article which claims that DDT is the only effective control for the tussock moth. The letter refers to previous information about two biological controls, tussock moth virus and *Bacillus thuringiensis*, which seem to provide better results than DDT and do not affect other life forms. The author claims that DDT is sometimes used indiscriminately and that "a renaissance" of DDT would be very unfortunate for uses where alternate, less harmful, controls exist.

74-2533. Sakai, F. (School of Pharmacol., Fac. of Med., Tokyo Univ. Tokyo, Japan). **[General remarks on toxicology, its problems and its future direction.]** *Igaku No Ayumi (Progr. Med.) 89(13): 740-744; 1974.* (Japanese)

It is difficult to define the term, poison, adequately for toxicologic purposes; however, in a general sense a poison can be defined as any substance which has a harmful effect. A substance administered to living organisms may arrive at the cellular level and cause a reaction in the living cells. If the reaction is an undesirable one, the action is regarded as harmful. The characteristics of and criteria for harmful reactions are considered, and harmful substances including pesticides are classified in accordance with the reaction characteristics, the quantitative problems, and the selection of experimental animals. Problems which must be dealt with in the future include the difficulty of extrapolating results from the cellular level to the entire organism and further to the human community; the importance of discovering new modes of harmful action, especially teratogenesis; and the necessity of finding methods for elucidating the harmful effects of combinations of substances.

74-2534. Tinsley, T. W.; Melnick, J. L.* (Dept. Virology and Epidemiol., Baylor Coll. Med., Houston, TX 77025). **Potential ecological hazards of pesticidal viruses.** *Intervirology 2(3): 206-208; 1973/74.* (5 references)

The use of viruses to control insect pests is being considered as an alternative to chemical pesticides. However, the plan is not without flaws: insects other than the target may be attacked. Reports of a high degree of species-specificity for insect viruses should be viewed with reserve since antibodies reacting with insect viruses have been found in domestic and wild animals, pigs, cattle, sheep, horses, dogs, deer, and in sera of laboratory workers handling insect viruses. Changes in the pathogenicity and specificity of pesticidal insect viruses could occur and cause a wider spectrum of host involvement. Unequivocal systems of virus identification are necessary. However, because of inadequate descriptions of viruses often found in the literature, it is very difficult to determine if a new virus has been isolated or if the virus is merely an extension of the host range of a previously recorded virus. Collaborative research programs on the in vitro specificity of insect viruses are recommended. When it is found that a candidate virus can infect vertebrate cells in vitro, results must be confirmed where possible in vivo.

74-2535. Reay, R. C. (Biol. Sci. Dept., Portsmouth Polytechnic, Park Road, Portsmouth, England). **Some recent pest control techniques and their environmental significance. Part 2. The use of genetic translocations, hormones, and antifeedants.** *Int. J. Environ. Stud. 5(2): 93-98; 1973.* (43 references)

Two main drawbacks in the use of conventional pesticides are the possibility of environmental pollution and the fact that chemical pesticides select strains of a pest which are resistant to economic and/or safe concentrations of the toxicant. By using chromosomal translocations, a resistant insect strain can be taken from the field and made susceptible, then the modified strain can be reintroduced into the field in the hope that the required properties would spread. The advantages of this technique are that it is highly specific and does not use chemicals of any kind. Insect moulting hormones and a whole range of related compounds are found in plants and may thus be a cheap source of the chemicals. However, since the hormones so far tested exogenously seem to be effective only at high concentrations, they involve some of the same risks as conventional pesticides. Also, there is some evidence that ecdysones may be nonspecific, and there may be great danger in disseminating materials related to mammalian hormones. However, some terpenoids discovered recently with juvenile-hormone-like activity are more specific than any ecdysones yet discovered. Some antifeeding agents appear naturally in plants. However, since there is such a wide range of chemicals under investigation for their antifeeding activity, it is difficult to assess possible effects on the ecosystem.

74-2536. Jukes, T. H. (Univ. California, 1414 S. Tenth St., Richmond, CA 94804). **DDT.** *J. Amer. Med. Ass 229(5): 571-573; 1974.* (13 references)

This article provides answers to eight frequently asked questions about DDT with the hope that the ban on DDT will be lifted. DDT is stored in body fat, but is not cumulative. It is present in human breast milk but, judging from animal experiments, the levels present should be harmless. The author thinks it unlikely that DDT is carcinogenic to man, based on lack of cancer in humans exposed to high levels of DDT over many years. The DDT level in the North Atlantic is 1 part/trillion, the lower figure resulting from DDT decomposition in sea water. DDT is also decomposed by UV light in the air. Practices which are harmful to wildlife such as spraying trees or spraying over water have been discontinued. EPA hearings in 1973 stated that harmful effects on birds eggs have not been proven caused by DDT rather

than other contaminants. Supermarket foods do not contain harmful DDT levels; organic foods have contained pesticide residues as often as regular food. The gypsy moth, which has created an ecological disaster by denuding miles of woodland, is worse than DDT. DDT was banned by the EPA despite a contrary recommendation by the examiner at the EPA hearings on DDT.

74-2537. Borlaug, N. E. (Author address not given). **In defence of DDT and other pesticides.** *Pesticides 8(5): 14-19; 1974.*

This article is an answer to environmentalists who demand discontinuation of the use of chemical compounds. The author emphasizes the need to insure food supplies against biological and physical catastrophes and to prevent, instead of treat, famine. He claims that people in industrial countries have little appreciation of the vital need to produce high-yielding strains of wheat, rice, maize, sorghum, and millet for the people of developing nations. A Green Revolution is in progress; tremendous progress in cereal production in India, Pakistan, and the Philippines has occurred in the past three years and is beginning to occur in many other countries. However, the continued success of the Green Revolution depends upon the use of agricultural chemicals. The author claims that a great defect in *Silent Spring* was that the book left the impression that agriculture can do without conventional pesticides. Biological control for the present is inadequate. He cites the usefulness of DDT in wiping out malaria from many countries and its remarkable safety record and fears that imposing a DDT ban in the U.S. will be only the first of the steps leading to the banning of many other useful agricultural chemicals.

74-2538. Zwerman, P. J.; De Haan, F. A. M. (New York Coll. Agr. Life Sci., Cornell Univ., Ithaca, NY). **Significance of the soil in environmental quality improvement – a review.** *Sci. Total Environ. 2(2): 121-155; 1973.* (43 references)

The disturbance of natural equilibria by man is reviewed in terms of how certain natural physical, biological, and chemical relationships have been adversely affected. The impact of agriculture and industry on plant and animal ecosystems is discussed, and major forces bringing about instability of the soil are pointed out. One way in which agricultural soil has been polluted has been by the use of pesticides. The use of pesticides has been increasing over the past few years, and there is concern in the United States over their production and application. Among the pesticides causing the greatest concern are the chlorinated hydrocarbons and the inorganic compounds, copper sulfate, sodium chlorate, calcium arsenate, and lead arsenate. The organophosphorus and carbamate pesticides are more readily decomposed in the soil. Many pesticides, particularly DDT, have had damaging effects on wildlife largely due to their concentration in particular species via the food chain. While many states have passed legislation prohibiting the use of these persistent pesticides, many favor their controlled usage over abolition. The presence and stage of development of insect pests should be investigated prior to insecticide application to help reduce the amount, extent, and duration of application. The quantities of insecticides applied can also be reduced by changing formulations, and it is possible to control insects using means other than insecticides.

74-2539. Chapman, T. (Author address not given). **The future for pesticides.** *World Farming 15(12): 6-8; 1973.*

The world population is expected to rise to 4269 million by 1980 and 5068 million by 1990, with 56% of the present world population already undernourished. Thus, there will be considerable pressures to increase agricultural production. In the U.S.A. alone, insects, weeds, plant diseases, and nematodes account for losses of up to $15 billion annually. Pest and disease control will be of great importance. Balanced against arguments that the use of conventional pesticides is undesirable is the argument that the need to control insect pests in agriculture is essential if economic crop production is to continue. An alternative to an insecticide should, therefore, be equally effective or have other features which might counterbalance a lower efficacy. Of the 4500 insect species of economic importance, only 25% are under biological control. The present move to less toxic and less persistent chemicals is a sound one, provided effective, economical alternatives are available.

74-2540. Chapman, T. (Author address not given). **The future for pesticides.** *World Farming 16(1): 14-15; 1974.* (8 references)

Replacing conventional pesticides with compounds about which much less is known is not prudent. However, insect resistance to pesticides is likely to increase, necessitating a more intense search for new compounds with novel modes of action. The increase in R and D costs must be recouped in the market to provide an adequate return. With an increase in control of the use of insecticides will be an increase in emphasis on less toxic and less persistent materials. The use of herbicides will be considered regarding crop yield as well as studying the level of weed infestation at which it becomes economical to use a herbicide. Use of fungicides has been associated with more sophisticated agricultural methods and higher value crops. Development of fungicides capable of being transported in the phloem, thus expanding their possibilities for use, could revolutionize the use of fungicides in 10-15 years. The development of nematocides which can be applied to leaves, instead of in large quantities to the soil, will obviate many of the criticisms presently leveled at nematocides. To withdraw the use of pesticides in the absence of acceptable alternatives would be disastrous.

74-2541. Zee, J. A.; Simard, R. E.; Chhem, C.; Gosselin, C.; Martin, G. B. (Dep. Vivres, Fac. Sci. Agr. Aliment., Univ. Laval, Quebec G1K 7P4, Quebec, Canada). **Organochlorinated pesticides in ciders.** *Amer. J. Enol. Viticult. 24(3): 120-124; 1973.* (11 references)

Seventeen brands of Quebec (hard) ciders, containing 11-12% alcohol by volume, were analyzed by GLC for α-, β-, γ-BHC, heptachlor, aldrin, DDE, TDE, dieldrin, methoxychlor, heptachlor epoxide, *o,p'*-DDT, and *p,p'*-DDT. A method for extracting organochlorines from cider is described. Residue values for the various organochlorines were α- and β-BHC 0.01 to 0.10 ppb, γ-BHC 0.04 to 0.07, aldrin 0.01 to 0.02, heptachlor 0.03 to 0.04, DDE 0.01 to 0.04, TDE 0.03 to 0.09, *o,p'*-DDT 0.02, and *p,p'*-DDT 0.01 to 0.06 ppb. Pesticide residues in Quebec apples harvested in autumn 1971 and summer 1972 and analyzed 6-9 months later were 0.07 to 0.36 ppb DDE, 0.07 to 0.52 ppb TDE, and 0.07 to 0.30 ppb *p,p'*-DDT. Only about 20 ppb DDT is soluble in ciders. Therefore, even in cider made from highly contaminated apples, the maximum residue in the final product will be about 20 ppb, well beneath the legal tolerated values.

74-2542. Vaajakorpi, H. A.; Salonen, L. (Dept. Zool., Univ. Helsinki, P. Rautatiekatu 13, SF-00100 Helsinki 10, Finland). **Bioaccumulation and transfer of ^{14}C-DDT in a small pond ecosystem.** *Ann. Zool. Fenn. 10(4): 539-544; 1973.* (13 references)

A quantity of 7.43 mg ^{14}C-DDT of known activity plus 492.6 mg inactive carrier DDT were dissolved in one liter of acetone and pumped into a small polyhumous pond in southern Finland to give a level of 1 ppb. DDT in filtered water, suspended material, sediment, newt, two fish species, two plant species, and four invertebrates was monitored for 59 days by liquid scintillation counting. An applied combustion technique was used on all samples except filtered water before transfer into the scintillating liquid. The 3 μm seston attained the highest concentration of DDT in 24 hours (39.8 ppm) and 8 μm seston in 12 hours (20.6 ppm). DDT concentrations at the end of 59 days were higher in perch than in crucian carp, particularly in liver and gills. Highest perch concentration (23.80 ppm) was in mesenteric adipose tissue. Accumulation reached a peak (2.01 ppm) 4 days after application. Maximum accumulation in dragonfly larvae, which live on small bottom animals and plankton, was 0.54 ppm at 14 days, decreasing at 30 days. Maximum in caddis-fly larvae (removed from tubes) was 1.71 ppm in 4 days, with average concentrations 6 times that of dragonfly larvae. *Sphaerium* and *Notomecta* reached maximum levels in 2 and 4 days respectively. Average values in *Utricularia* were 7 times those in *Drepanocladus*.

74-2543. Oudbier, A. J.; Bloomer, A. W.; Price, H. A.; Welch, R. L. (Mich. Community Stud. Pestic., Mich. Dept. Pub. Health, Lansing, MI 48914). **Respiratory route of pesticide exposure as a potential health hazard.** *Bull. Environ. Contam. Toxicol. 12(1): 1-9; 1974.* (9 references)

Since spraymen of organophosphate pesticides are usually almost entirely covered to protect against dermal contact, it was thought that the respiratory route should be investigated as the source of short time high concentration exposure. A total of 22 paired midget impinger samples and respiratory pads from a dust respirator worn by sprayman during pesticide mixing and spraying operations were collected. Samples were analyzed by electron-capture gas chromatography and qualitatively by flame photometry for confirmation of organophosphates. The period of pesticide mixing and tank filling appeared to present the greater hazard to respiratory exposure. Wettable powder guthion (azinphosmethyl) (2.5 lbs of 50% dumped into a 500 gal spray tank) left 2,680 ng on the respirator pad and 354.6 ng in the corresponding impinger. When 6 quarts of 22% emulsifiable concentrate were used, no guthion was recovered. Captan, endosulfan, TDE, and diazinon were detected. Compounds used but not detected were copper sulfate, Cyprex (dodine), Fundal (chlordimeform), lead arsenate, magnesium sulfate, manzate, parathion, phygon, solubar, sulfur and Systox (demeton).

74-2544. Cheung, M. W. S. (Univ. Calif., Davis, CA). **Equilibrium and kinetic processes of the interactions of 4-amino-3,5,6-trichloropicolinic acid (Picloram) and *O,O*-diethyl *O*-*p*-nitrophenyl phosphorothiate (parathion) with soils.** *Diss. Abstr. Int. 35(1): 17B; 1974.*

The solubility and *pK*a of 4-amino-3,5,6-trichloropicolinic acid (picloram) were studied in relation to medium pH and temperature. Its molecular structures at various pH's were examined by infrared spectroscopic studies. This information and those from X-ray diffraction studies provided physical evidence to substantiate the proposed absorption mechanisms derived from a thermodynamic approach to the adsorption of picloram on Panoche clay loam, Palouse silty loam and Ephrata sandy loam soils. The relationship of the chemical and physical properties of the pesticides and soils to the fate and behavior of the pesticides in the soil environment were elucidated from the results of the adsorption studies under various experimental conditions. The importance and usefulness of the thermodynamic parameters in assigning and differentiating adsorption mechanisms were stressed. Simple experimental and mathematical procedures to obtain the initial adsorption and desorption rates of pesticides on soil were developed. Picloram and *O,O*-diethyl *O*-*p*-nitrophenyl phosphorothioate (parathion) were used to examine the kinetics of interaction with Panoche clay loam and Palouse silty loam soils. The mechanisms of interaction associated with the adsorption and desorption processes were explained by using the activation parameters and physical evidence provided by X-ray diffraction studies and adsorption phenomena with the soil components.

(Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 74-16,248).

74-2545. Waybrant, R. C. (Purdue Univ., Lafayette, IN). **Factors controlling the distribution and persistence of lindane and DDE in lentic environments.** *Diss. Abstr. Int. 35(1): 367B-368B; 1974.*

The persistence and distribution of DDE and lindane were studied for one year after addition of each compound at a rate of 200 ppt (parts per trillion) to the epilimnion of a thermally stratified, ultra-oligotrophic, flooded limestone quarry; the addition rate was 50 ppt for the entire water mass. Water, bottom sediments, limestone rock slabs, zooplankton and fish were analyzed; dissolved oxygen and temperature profiles were monitored. The persistence of the insecticides seemed to be largely controlled by adsorption onto suspended particles. DDT, which has a much larger adsorption coefficient than lindane, was lost from the water approximately 15 times as fast as lindane was. After three months, 85% of the measured DDE was located in the bottom sediments, while 72% of the measured lindane was still in the overlying water. DDE was biologically magnified to a greater extent than was lindane, and the DDE accumulated and retained by the invertebrates was closely correlated with DDE concentration in the water. Equilibrium with lindane between fish and water was reached about 12 times faster than with DDE. A simple two-compartment model was developed that may be useful for predicting the distribution of a variety of nonionic compounds in lakes, and the usefulness of quarries as large-scale lake models was demonstrated. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-15,256).

74-2546. Weber, J. B.; Monaco, T. J.; Worsham, A. D. (North Carolina State Univ., Raleigh, NC). **What happens to herbicides in the environment?** *Down Earth 29(3): 12-14; 1973.*

Once herbicides are introduced into the environment, herbicide degradation processes and herbicide transfer processes play a part in determining the ultimate fate of the chemicals. Three specific degradation processes serve to break down the herbicides and change their chemical composition: biological decomposition; chemical decomposition, including oxidation, reduction, and hydrolysis; and photodecomposition. Six transfer processes are important in determining what happens to herbicides in the environment: absorption and exudation by plants and animals; retention in vegetation followed by transfer in the harvested product; adsorption by soil particles; movement through the air and into the atmosphere; surface runoff into ponds, rivers, and oceans; and movement laterally or vertically through the soil. All the degradation processes are intimately associated, adsorption probably being the key process. The transfer processes are usually reversible and in dynamic equilibrium with the system. Except for gross misapplication and overuse, the degradation processes described will break herbicides down into safe or nontoxic compounds. There is no evidence of potential build-up or persistence in the soil to contaminate the environment.

74-2547. Snitko, V. M.; Levchenko, Ye. A. (Black Sea Basin Sanit. Epidemiol. Station, Black Sea-Azov Marine Hyg. Dept., Odessa, USSR). **Fumigant, snizhayuschiy opasnost' dezinfektsinonnykh rabt i ostatochnyye bromidy v produktake. [Fumigant reducing the hazard of disinfection operations and residual bromides in products.]** *Gig. Sanit. 38(12): 96-97; 1973.* (Russian)

The hygienic advantages of a new fumigant (a mixture of methyl bromide and carbon dioxide) used as an insecticide and rodenticide in closed spaces in commercial vessels are described. The addition of carbon dioxide to methyl bromide resulted in a 50% reduction in the methyl bromide expenditure, 30-50% reduction in the fumigation time, accelerated liberation of methyl bromide from the products carried on board, and in 6-8 fold reductions of the methyl bromide residue levels in the fumigated products. The methyl bromide residue levels ranged from 3 to 8 mg/kg against 20-70 mg/kg after treatment with methyl bromide alone. Coffee beans contained no methyl bromide after treatment. The new formula also alleviates the hazards of disinfestation operations.

74-2548. Kamata, T. (School of Hygiene, Faculty of Medicine, Hiroshima Univ., Hiroshima, Japan). **Hygienic studies on pesticide residues: Part 4. Environmental contamination by organochlorine pesticides.** *Hiroshima Daigaku Igaku Zasshi (Med. J. Hiroshima Univ.) 22(5-6): 315-325; 1974.* (40 references) (Japanese)

From June to Nov. 1973, two years after the ban of organochlorine pesticides in Japan, specimens of various foods and human tissues were analyzed for α-, β- and γ-BHC, p,p'-DDE, and p,p'-DDT. The concentration of BHC in vegetables was a few ppb; that of DDT was lower than that of BHC, showing no relation to the pesticide residues in soil. The levels of BHC and DDT in cow milk, cattle fat, and swine fat decreased as that in animal feed decreased. An accumulation of DDT and BHC (respectively from less than 0.001 to 0.052, and from 0.001 to 0.090 ppm) in sea foods was recognized, suggesting a problem for Japanese who eat large quantities of sea foods. The levels of DDT and BHC in human milk and human fat did not decrease as compared to the levels at the time when organochlorine pesticides were used. Since human beings are at the end of the food-chain and releasing of organochlorine pesticide residues is time-dependent it will take a long time to reduce the level in humans.

74-2549. Ogura, H.; Takahashi, Y.; Omura, S.; Tsunoo, K. (Ishikawa Pref. Res. Lab. for Pub. Health and Environment Ishikawa, Japan). **[Results of investigation of organochlorine pesticide residues in animal foodstuffs produced in Ishikawa Prefecture, Part 1. Residue of BHC and DDT in fish and beet.]** *Ishikawa-Ken Eisei Kogai Kenkyusho Nenpo Annu. Rep. Ishakawa Res. Lab. Pub. Health Environ.) 9: 51-54; 1972.* (2 references) (Japanese)

Ten specimens of six kinds of fish from known locales and five specimens of beef from the muscle part near the mediastinum were analyzed for BHC and DDT derivatives. Homogenization, extraction, cleanup, and gas chromatography were used. The fishes were about 30 cm in length and only their meat (including skin) was analyzed. The recovery of α, β δ-BHC, *p,p'*-DDT, *p,p'*-DDE, and *p,p'*-DDD (TDE) added to homogenized beef was on the average 92.0, 98.2, 87.0, 87.2, 93.6 and 93.8%. BHC was detected in all specimens, and DDT was detected in all specimens except some specimens of fresh water fishes. Total BHC at 0.024 ppm was detected even in fishes which live in mountain rivers. The range of both residues in beef specimens was 0.049-0.458 ppm total BHC and 0.015-0.036 ppm total DDT. The present analyses were carried out in 1971 after the use of DDT and BHC was banned.

74-2550. Kadoum, A. M.; LaHue, D. W. (Dept. of Entomol., Kansas State Univ., Manhattan, KS 66506). **Penetration of malathion in stored corn, wheat and sorghum grain.** *J. Econ. Entomol. 67(4): 477-478; 1974.* (9 references)

Corn, wheat, and sorghum samples, adjusted to 14% moisture content, were treated with malathion emulsion, then stored at 26.7°C and 60% relative humidity. Residues were determined by gas chromatography in extracts from the grain surface or from ground grain samples. The rates of malathion degradation on and in the various grain types differed little. At all sampling times, malathion residue was greater on the exterior than on the interior of sorghum kernels. All three grains showed more residue inside the kernels 1 month after treatment than they did at 24 hr, 3 and 6 months. Malathion apparently penetrated the kernels most rapidly during the first month after treatment; thereafter, the degradation rate masked the penetration rate. Residue loss from the surface resulted from penetration as well as from degradation of malathion. Residues in all three grains decreased by about 9-fold. Most of this was accounted for by the reduction in residues on the exterior, while residues on the interior of the grain remained at approximately 1/10 of the amount applied. Grain moisture content influences pesticide degradation rate by maintaining viability of the grain and serving as a medium for biochemical reactions.

74-2551. Jones, E. E., Jr. (Farmstead Water Syst. Res., Agr. Res. Serv., USDA, Beltsville, MD). **Well construction helps determine water quality.** *J. Environ. Health 35(5): 443-450; 1973.* (3 references)

The relationship between pesticides in water and poor well construction has been recognized. Three farmstead wells characterized by a lack of adequate sanitary protection are described. Wells found to be contaminated should be reconstructed or abandoned and properly closed. Pesticides in farmstead water supplies are almost always associated with variable turbidity and gross bacterial contamination. Rapid change in water quality with rainfall and signs of surface contamination are indications of poor sanitation in a well with apparently adequate sanitary protection.

74-2552. Rao, P. S. C.; Green, R. E.; Balasubramanian, V.; Kanehiro, Y. (Dept. of Agronomy and Soil Sci., Univ. of Hawaii, Honolulu, HI 96822). **Field studies of solute movement in a highly aggregated oxisol with intermittent flooding: II. Picloram.** *J. Environ. Qual. 3(3): 197-202; 1974.* (21 references)

Most of the applied herbicide picloram (potassium salt of 4-amino-3,5,6-trichloropicolinic acid) was retained in the top 40-cm depth of the Molokai soil with cumulative applications of 48 to 74 cm water following application of the chemical to the soil surface. Distribution of picloram in the soil profile one week after each irrigation was determined by in situ sampling of soil solution with porous ceramic cups placed at several depths. Although movement of the picloram peak was retarded more than was anticipated from equilibrium adsorption measurements, a significant fraction of the applied herbicide moved ahead of the peak deep into the profile (down to the 143-cm depth) after a single application of 24-cm water. Rapid flow through macropore sequences combined with temporary retention of picloram in aggregate micropores appear to be responsible for the unusual pattern of movement. Published data for nitrate movement in the same field plots of Molokai soil were compared with picloram movement data to provide a measure of the relative mobility of these solutes. A comparison of the results reported here with published field data of solute leaching in other soils indicated a greater retardation of solute peak movement in Molokai soil than in less aggregated soils. (Author abstract by permission)

74-2553. Khan, S. U. (Chem. and Biol. Res. Inst., Canada Dept. Agr., Ottawa, Ontario, Canada K1A OC6). **Adsorption of bipyridylium herbicides by humic acid.** *J. Environ. Qual. 3(3): 202-206; 1974.* (21 references)

The adsorption of paraquat (1,1'-dimethyl-4,4'-bipyridylium dichloride) and diquat (1,1'-ethylene-2,2'-bipyrdylium dibromide) by various cation-saturated humic acids was investigated. The cation order for increasing adsorption for the two herbicides was nearly the same and followed the sequence: $Al^{3+} < Fe^{3+} < Cu^{2+} < Ni^{2+} < Zn^{2+} < Co^{2+} < Mn^{2+} < H^{+} < Ca^{2+} < Mg^{2+}$. It

was suggested that the colloid geometry of humic material and the shape, size and nature of bipyridylium cation would influence the adsorption of the herbicide. By infrared spectroscopic and potentiometric techniques evidence was procured for the involvement of ion-exchange and charge transfer mechanisms in the adsorption of bipyridylium herbicides by humic acid. (Author abstract by permission)

74-2554. Willis, G. H.; Wander, R. C.; Southwick, L. M. (Louisiana Agricultural Exp. Sta., Baton Rouge, LA 70803). **Degradation of trifluralin in soil suspensions as related to redox potential.** *J. Environ. Qual. 3(3): 262-265; 1974.* (23 references)

A system for controlling redox potential in soil suspensions was used to investigate the relationship between oxidation-reduction potential (Eh) and the rate of trifluralin (α,α,α-trifluoro-2,6-dinitro-*N*,*N*-dipropyl-*p*-toluidine) degradation. Redox potentials of +450, +250, +150, +50, 0, and -50 mV were imposed on trifluralin-amended (1 ppm oven-dry weight soil basis) soil suspensions (100 g soil in 300 ml H_2O) for 21 days. Results indicated that exclusion of O_2 by soil flooding initiated rapid trifluralin degradation only when the Eh decreased below a critical range between +150 and +50 mV. There was no clear-cut relationship between trifluralin degradation and microbioligical respiratory activity (CO_2 evolution). If soil flooding is to be a practical cultural technique for accelerating the rate of degradation of persistent pesticides, steps may have to be taken to ensure that soil Eh decreases below a critical value for some required period of time. This may include soil incorporation of a readily available carbon or energy source to stimulate an active soil microbial population to enhance lowering of the soil Eh. (Author abstract by permission)

74-2555. Parr, J. F.; Willis, G. H.; McDowell, L. L.; Murphree, C. E.; Smith, S. (Agr. Res. Serv., UDSA, Baton Rouge, LA 70803). **Automatic pumping sampler for evaluating the transport of pesticides in suspended sediment.** *J. Environ. Qual. 3(3): 292-294; 1974.* (7 references)

Laboratory tests were conducted to evaluate the utility of an automatic pumping sampler for assessing the transport and concentration of pesticides in suspended sediment. Pesticide-sediment-water mixtures were formulated with pesticide-sediment ratios ranging from 1:15,000 to 1:500. After stirring periods of 10 and 60 min, those formulations were pumped through the sampler and aliquots collected for pesticide analysis. Recovery of DDT, trifluralin, toxaphene, and mirex exceeded 90%, based on their concentrations immediately prior to pumping. Adsorption of pesticides to the various plastic, rubber, and fiberglass sampler components was minimized by the high flow velocity and rapid delivery systems which ensured a short time of contact (seconds) between the sample and internal surfaces. These tests indicate that the sampler is suitable for use in evaluating the transport of relatively water-insoluble pesticides in suspended sediment. (Author abstract by permission)

74-2556. Mel'nikov, N. N. (All-Union Sci. Res. Inst. Chemical Plant Protection, USSR). **Pestitsidy i okruzhayushchaya sreda (soyedineniya rtuti). [Pesticides and the environment (mercury compounds).]** *Khim. Sel. Khoz. 12(2): 34-37; 1974.* (21 references) (Russian)

General problems of mercury compounds in the environment and in living organisms are discussed. Mercury levels ranging from 0.1 to 0.7 mg/kg were detected in saltwater fish, and mercury contents of up to 12.13 mg/kg were found in freshwater fish. Mercury was eliminated from the animal slowly. Panogen was more readily adsorbed by different types of soils than phenylmercury acetate. The mercury levels in beans, cabbages, onions, potatoes, and tomatoes growing in such soils accounted for 0.53 to over 3% of those found in the soils. The use of organomercurial seed dressing agents does not represent a noteworthy source of mercury contamination even after periods as long as 20 years. Organomercurial compounds were reduced to hydrocarbons and metallic mercury by soil microorganisms under anaerobic conditions. Methane, ethane, benzene, and metallic mercury were the decay products of methyl mercury salts, ethylmercury, and phenylmercury. Metallic mercury is then usually converted to insoluble oxide or sulfite form. Methylmercury and dimethylmercury salts formed from inorganic mercury compounds and metallic mercury in the living organisms.

74-2557. Yoshida, K.; Nishikawa, M.; Baba, K.; Kuwano, K.; Matsumura, T. (Nagasaki Prefect. Res. Inst. for Hygiene, Nagasaki, Japan). **[Results of inspection of pesticidal residues in foods. Part 3.]** *Nagasaki-ken Eisei Kenkyusho Shoho (Annu. Rep. Nagasaki Prefect. Res. Inst. Hyg.) 12: 38-39; 1974.* (Japanese)

One hundred forty two specimens of foodstuff including agricultural crops, meats, eggs, cow milk, and human milk were inspected in 1971. Agricultural crops were inspected for As, Pb, BHC, DDT, dieldrin, endrin, parathion, EPN, malathion, and carbaryl. Only one specimen of cucumber contained a residue of 0.008 ppm over the official standard of endrin. Although a minute amount of BHC was detected in all specimens except Chinese cabbage, all other above-mentioned residues were not detected. Eggs, meats, cow milk, and human milk were inspected for BHC isomers and DDT and its derivatives. BHC was found in the decreasing order of beef, pork, chicken, and egg; BHC was lower in beef and chicken and higher in pork than in 1970. DDT derivatives were in the decreasing order of pork, chicken, beef, and egg; there was no difference in values compared to those of 1970 in beef and chicken, but values were

higher in pork. Dieldrin had decreased in all foods since 1970. In cow milk BHC decreased greatly from 0.092 to 0.036 ppm, but with no difference in values of DDT and dieldrin. BHC and DDT decreased in human milk. The smaller decrease of DDT in pork and chicken could stem from their feeds which are imported from countries where DDT is still used.

74-2558. Wassermann, M. (School of Labor Hygiene, Fac. of Med., Hebrew Univ., Israel). **[Accumulation of polychlorohydrocarbons in humans in Israel.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 772; 1974.* (Japanese)

The authors reported the accumulation of total DDT, dieldrin, and PCB in 47 adipose tissue samples removed from the outer abdominal wall of healthy 25- to 44-year-old persons killed in accidents. After extracting fats from the adipose tissue, organochlorine pesticides were separated from PCB in fats by column chromatography. The total DDT content was 9.94 ppm on the average (14.56 in men and 4.62 ppm in women); dieldrin content was 0.38 ppm on the average (0.55 in men and 0.21 ppm in women); and PCB content was 2.75 ppm on the average (3.00 in men and 2.45 in women). The data shows that there is an inverse correlation between the accumulated amounts of DDT and PCB. That is, the accumulation of PCB is lower in persons with higher accumulations of total DDT than in persons with lower accumulations of total DDT. (Proc. 1st Congress of Asian Rural Medicine, Oct. 24-27, 1973, Nagano, Japan)

74-2559. Takase, I.; Tsuda, H.; Yoshimoto, Y. (Agr. Chem. Inst. of Nihon Tokushu Noyaku Seizo K.K., Tokyo, Japan). **The fate of Disyston active ingredient in soil.** *Pflanzenschutz-Nachr. 25(1): 43-63; 1972.* (12 references)

Test soil samples (various clay loams, sandy loam, kaolinic clay, sandy soil) to which 6 ppm disulfoton had been added, were analyzed at intervals of 5, 7, 14, 28, and 49 days, and degradation rates were determined. In clay loam, 29% of disulfoton remained after 3 days and less than 1% after 28 days, while the oxidized metabolites (sulfoxides and sulfones) increased to 27% and 67% respectively in 28 days. The amounts of disulfoton at 28 days in sandy loam and sandy soil were 2% and 4% respectively. In all soil types, slight amounts of the disulfoton were still present at 28 days. In a soil loading experiment it was found that movement to a lower layer in a clay loam was greater with 40% moisture content than with 20%. Twenty-five and 16% respectively were found in the lower layer at 42 days. The amount translocated to an upper soil level (10%) was irrespective of moisture content. An emulsifiable concentrate of disulfoton moved to the lower layer in greater amounts than after granular application, irrespective of moisture content and soil type. Larger amounts of oxidative metabolites were found with application of emulsifiable concentrate. Seven days after surface application of Disyston Granular, only slight amounts had translocated to lower levels; however, amounts after 21 and 42 days were 31% and 35% respectively, chiefly as the sulfoxide and sulfone. Oxidation to sulfoxide and sulfone proceeds faster after surface application than after soil loading treatment. In paddy soils effective residues after 1, 4, and 10 days were 78%, 47%, and 36% respectively. The ratio of active compounds in water to soil was 4:1 at one day, 1:1 at 4 days, changing further in favor of the soil layer in time.

74-2560. Brown, G. E. (Florida Dept. Citrus, Univ. Florida, Inst. Food Agr. Sci., Agr. Res. Educ. Cent., Lake Alfred, FL 33850). **Benomyl residues in Valencia oranges from postharvest applications containing emulsified oil.** *Phytopathology 64(4): 539-542; 1974.* (13 references)

Blemish-free Valencia oranges were treated with benomyl (50% WP) suspended in water (pH 5.7) with and without the addition of Ortho Volck spray oil (petroleum 97%, inert ingredients 3%). Methyl-2-benzimidazolecarbamate (BCM) residues increased 2-3 fold when 1% oil was added to applications of 500 ppm 0 to 3 days prior to use. Concentrations of 150 to 175 ppm of benomyl with 1% oil gave whole fruit residues similar to those obtained with an application of 500 ppm benomyl alone. The addition of 0.25% oil increased surface, flavedo, albedo, and pulp residues. BCM residues were increased by adding oil either to benomyl suspensions which were applied immediately after preparation (and which contained, therefore, primarily benomyl) or to suspensions prepared seven days previously (and which contained, therefore, primarily BCM). However, no increase in residue occurred when benomyl-oil preparations were allowed to stand seven days before use.

74-2561. Waldron, A. C.; Naber, E. C. (Pestic. Anal. Lab., Cooperative Ext. Serv., Dept. of Entomol. and Dept. of Poultry Sci., Ohio State Univ., Columbus, OH 43210). **Importance of feed as an unavoidable source of pesticide contamination in poultry meat and eggs.** *Poultry Sci. 53(4): 1359-1371; 1974.* (20 references)

General and broad occurrences of minute organochlorine pesticide residues were indicated in feedstuffs used in poultry feeds in the United States. Corn, soybean meal, alfalfa meal, fish meal, and fat samples were collected and submitted bimonthly over a 24 month period from Maine, Georgia, Texas, Ohio, and California and analyzed for aldrin, dieldrin, heptachlor, heptachlor epoxide, lindane, DDE, DDD (TDE), *o,p'*-DDT, *p,p'*-DDT, and methoxychlor. Concentrations of individual pesticides when occurring were generally in the range of 10 to 50 ppb although higher concentrations occasionally occurred. DDT and its metabolites were the most

frequently occurring organochlorine pesticides detected. The highest concentration and frequency of residues detected were associated with fish meal and fat samples. Occurrence of residues in corn and soybean meal was generally infrequent and at very low concentrations. The presence of pesticide residues was very closely correlated with the areas of high crop production and hence greater pesticide use. In general, it appears that poultry feeds formulated from feedstuff sources as analyzed in this study (corn and soybean meal constituting by far the major part of the poultry ration) would not contain organochlorine pesticide residues large enough to cause any major contamination problems with poultry products. (Author abstract by permission)

74-2562. Nethery, A. A. (Res. Dept., Agr. Chem. Div., FMC Corp., Middleport, NY 14105). **Movement and distribution of NIA 23486 in various soil types.** *Proc. Northeast. Weed Sci. Soc. 28: 133-139; 1974.* (8 references)

An aqueous solution of ^{14}C-NIA-23486 was shaken for 24 hours with each of eight soil types. Adsorption to the soil varied from 7.9 for loam to 18.4% for silty clay loam. The percent adsorption is correlated with the adsorption constant, K, for each soil. The capacity of each soil type to adsorb the herbicide is correlated closely with cation exchange capacity. Ten ml of aqueous herbicide solution added to soil packed into cylindrical columns (6 mm x 20 cm) resulted in leaching depths of 5 cm (for silty clay loam) to 14 cm (for silt loam). Cation exchange capacity was the most significant single factor correlated with depth of penetration. Mobility of ^{14} C-NIA-23486 correlated inversely with adsorption by the soil, which in turn is dependent on cation exchange capacity.

74-2563. Bullivant, M. J.; Pattenden, G. (Dept. Chem., Univ. Coll., Cardiff, Wales). **Fundamental photodegradation pathways for rethrolone moieties of the pyrethin insecticides.** *Pyrethrum Post 12(2): 64-69, 75; 1973.*

Direct photolysis of a 0.5% solution of the methyl ether of allethrolone in hexane resulted in slow conversion of the prop-2-enyl side chain to a cyclopropyl side chain in 83% yield. Similarly, direct irradiation of the acetate of allethrolone resulted in the corresponding cyclopropane. In contrast, photolysis of the acetate and methyl ether derivatives of cinerolone and jasmololone did not produce cyclopropane photoproducts. Instead, cis-trans-isomerization recurred around the disubstituted double bonds in the side chains, resulting in formation of the corresponding trans-compounds. Pyrethrolone under irradiation appears to undergo competitive isomerization-rearrangement accompanied by extensive polymerization. Possible mechanisms for the rearrangements are discussed. Photolysis of allethrin resulted in formation of the cyclopropane. Structures were determined on the basis of spectral (i.r., u.v., n.m.r.) evidence.

74-2564. Wessels, C. (Br. Plant Protection, Dept. Res. Specialist Serv., Ministry Agr., Salisbury, Rhodesia). **Residues of three organochlorine insecticides in groundnut plants (*Arachis hypogaea* L.) in Rhodesia.** *Rhod. J. Agr. Res. 12(1): 69-75; 1974.* (6 references)

Aldrin, dieldrin, and DDT were used to control soil and foliar pests of groundnuts (*Arachis hypogaea* L.) grown in a reddish brown, medium textured, siallitic soil or a deep, paraferrallitic sand derived from granite. Greater pesticide residues were found in the plants than in the surrounding soil. Soil treatments of aldrin and dieldrin prior to planting resulted in residues of dieldrin in the kernels at harvest which were in excess of accepted safety tolerances, and greater accumulations occurred in the roots and shells. A DDT drench application to the soil soon after planting resulted in acceptably low DDT residues in the kernels, and the kernels from plants sprayed regularly with DDT had even lower residues; however, foliage from the latter plants was seriously contaminated and could not be used for animal fodder. The average DDT concentration in the foliage decreased between 85 and 94% in the month following each spray application. Thus, aldrin and dieldrin should not be used for the control of soil pests of groundnuts and the foliage of plants treated with DDT should not be used as stock feed.

74-2565. Sunami, S. (School of Public Health, Kawasaki Medical College, Kawasaki, Kanagawa, Japan) **[A study on the progressive decrease of γ-BHC concentration in an experimental polyvinyl chloride greenhouse.]** *Sangyo Igaku (Jap. J. Ind. Health) 16(1): 28-29; 1974.* (4 references) (Japanese)

In an experimental polyvinyl chloride green house with a semi-circular section (5.4 X 5.4 X 2.0 m) having a small restroom, experimental spraying was carried out with a 500-fold dilution of 10% γ-BHC emulsifiable concentrate at a rate of 288 ml/2 m to the ground of the green house. Specimens of the air were taken from the working room and the restroom at their centers 1.5 m from the ground just after, 2, and 5 hr after spraying for 12.5-25 min at a rate of 4 m/min by a series of 125 ml impingers containing hexane. The measuring of γ-BHC was carried out by a gas chromatograph with ECD. With windows and doors shut and without a fan, the γ-BHC concentration in the work room was 140 micrograms/m^3 and was reduced to 11.5 (8.2%) and 3.5 micrograms/m^3 (25%) after 2 and 5 hr. Those in the restroom were generally lower by about half. With a fan only in the restroom, the concentration of air in the workroom was at first 135.0 micrograms/m^3 and decreased respectively to 5.0 (3.7%) and 3.0 (2.2%) micrograms/m^3 after 2 and 5 hr. No γ-BHC was detected from just after to 5 hr after the spraying in the restroom.

74-2566. Thomson, J. M.; Davie, J. D. S. (Dept. Zool., Univ. Queensland, Australia). **Pesticide residues in the**

fauna of the Brisbane River estuary. *Search 5(4): 152; 1974.* (5 references)

DDT, DDE, TDE, aldrin, lindane, and HCB in the flesh of eight species of fish, one species of crab, one holothurian, and three species of molluscs in the Bris bane River estuary over a three-year period were identified and determined on an electron capture detector gas chromatograph. Dieldrin, 2,4-D, and 2,4,5-T were tested for only occasionally. All substances were present from time to time, aldrin less regularly than the others. Only DDT was regularly present in more than trace quantities. Highest concentrations were usually found in samples from the mouth of the river. There was little temporal variation except that DDT was highest in August. Except for two samples, concentrations were generally less than 1.00 ppm. There was individual variability in the rate of uptake. Pesticide levels measured were well below the upper safe levels for human consumption prescribed by Australian health authorities and below the levels shown to be lethal for fish.

74-2567. Tomizawa, C. (Nat. Inst. of Agr. Sci., Min. of Agr. and Forestry, Tokyo, Japan). **[Environmental pollution by mercury mediated by pesticides.]** *Shokuryo No Kagaku (Sci. Foods) 18: 39-45; 1974.* (Japanese)

Organomercury compounds as fungicides against rice blast and as seed-disinfectants are reviewed. The most extensively applied organomercury pesticide was phenyl mercury acetate accounting for about 60% of total organic mercury compounds, followed by seed-disinfectants consisting of ethyl mercury chloride and ethyl mercury hydrogen phosphate at 20%. The average applied amount of mercury as phenyl mercury compounds in paddy field was 73.6 g/10 are, which corresponds to 0.285-0.713 ppm of soil. The residual mercury in rice grain was about 0.2 ppm. According to model experiments and actual soil analysis, the soil mercury residues in paddy fields, in orange groves, and in apple orchards were respectively 0.13-1.04, 0.10-0.55 and 0.36-2.20 ppm. In Japan, the mercury seed-disinfectant was only used in a limited area (rice seedling bed); however, the waste water of seed-dressing was thrown into water-ways resulting in environmental pollution. An interesting case of biological accumulation of methyl mercury iodide and methyl mercury acetate was described in which the rate of concentration between seasoning greens and larvae of common white butterflies ranged between 7.7-18.8.

74-2568. Davidson, J. M.; Mansell, R. S.; Baker, D. R. (Dept. of Agron., Oklahoma State Univ., Stillwater, OK). **Herbicide distributions within a soil profile and their dependence upon adsorption-desorption.** *Soil Crop Sci. Soc. Fla. Proc. 32: 36-41; 1973.* (17 references)

Numerical solutions of partial differential equations that describe the transport of an adsorbed chemical through a porous medium have previously been presented. In this paper a numerical solution is used to describe the distribution of two water-soluble preemergence herbicides with soil depth, following different infiltration periods. The distributions of solution and adsorbed phases of each herbicide with soil depth are discussed. A constant infiltration rate and constant soil-water content in the transition zone were assumed. Adsorption and desorption processes were single and non-single valued first-order kinetics. The length of the soil profile over which distribution occurs is increased, and maximum herbicide solution concentration is decreased by non-singularity between adsorption and desorption relationships. Wide herbicide distributions occur in soils with high infiltration rates and/or soil-herbicide systems with small kinetic rate coefficients. Using distribution coefficients to estimate the position of the invading herbicide front during infiltration is suitable only for equilibrium adsorption and when herbicide concentrations in adsorbed and solution phases are linearly related at equilibrium.

74-2569. Parr, J. F.; Smith, S. (U.S. Dept. of Agr., Baton Rouge, LA). **Degradation of DDT in an Everglades muck as affected by lime, ferrous iron, and anaerobiosis.** *Soil Sci. 118(1): 45-52; 1974.* (18 references)

DDT was applied to Everglades muck which had been amended with alfalfa meal, ferrous iron, and lime to give a concentration of 10 ppm based on oven dry weight of muck and incubated for 4 weeks under moist aerobic, moist anaerobic, and flooded anaerobic conditions. Amending the soil with alfalfa meal or ferrous iron (2000 ppm) or with lime under aseptic conditions caused little conversion to TDE in anerobic conditions. However, alfalfa and lime (to pH 6.8) alone or in combination with ferrous iron caused 10.5 and 10.1% respectively recovery of TDE. Stirring flooded peaty muck incubated anaerobically increased degradation to TDE in all cases. Percent recoveries of TDE in stirred muck were 13.9% for alfalfa amended muck, 18.7 for alfalfa and lime, 25.8 for alfalfa and iron, and 56.2% for alfalfa, lime and iron. Bacterial populations in the anaerobic environment increased in limed mucks. This was correlated with greater respiratory activity and increased DDT degradation. DDT degradation increased as redox potential decreased.

74-2570. Farmer, W. J.; Aochi, Y. (Dept. Soil Sci., Univ. California, Riverside, CA). **Picloram sorption by soils.** *Soil Sci. Soc. Amer. Proc. 38(3): 418-423; 1974.* (14 references)

Picloram (4-amino-3,5,6-trichloropicolinic acid) adsorption-desorption isotherms were determined on six western USA soils. Adsorption isotherms were determined as a function of temperature, soil/solution ratio, and solution ionic strength. Special attention was given to the effects of pH and organic matter content in the analysis of the result. Adsorption increased with

increasing organic matter with soils varying in organic matter content from 0.94% to 4.2%. Variations in adsorption between soils were not correlated with clay content or soil pH in the pH range 5.6 to 7.4, but increased adsorption resulted with decreasing solution pH of any individual soil. Sorption was described by the Freundlich isotherm at equilibrium concentrations less than 20 μg/ml. Temperature had only a slight effect on adsorption by the three soils examined. Increasing temperature from 10 to 20 to 30°C generally resulted in decreased adsorption. Increasing the soil/solution ratio from 1:5 to 1:2 increased the Freundlich *k* value for the five soils tested. Freundlich *k* values were higher for the desorption isotherms than for the adsorption isotherms for all six soils. Increased adsorption with increasing ionic strength was predicted from associated pH changes and the dissociation constant for picloram. (Author abstract by permission)

74-2571. O'Connor, G. A.; Anderson, J. U. (New Mexico State Univ., Las Cruces, NM 88003). **Soil factors affecting the adsorption of 2,4,5-T.** *Soil Sci. Soc. Amer. Proc. 38(3): 433-436; 1974.* (13 references)

Factors expected to affect the adsorption of 2,4,5-T (2,4,5-trichlorophenoxyacetic acid) on four soils of the western USA were studied. The effects were examined by equilibrating solutions of 2,4,5-T with soils in their natural condition, after Ca-saturation, and with samples of the same soils treated to remove soil constituents expected to affect adsorption. Organic matter was an important contributor to 2,4,5-T adsorption, and, in some soils, was the only adsorbent of significance. Oxides of Fe and Al did not contribute much to adsorption in the soils studied although the pH of soils studied was only slightly acid to alkaline. Allophane was apparently an effective adsorbent when the Si/Al ratio of the allophane was high. (Author abstract by permission)

74-2572. Burkser, G. V.; Zhumamudinov, S. (Khirgiz Inst. Agriculture, USSR). **Pokazateli sanitarnogo sostoyaniya vody malykh rek. [Determination of sanitary characteristics of water in small streams.]** *Veterinariya (Moscow) 4: 32-34; 1974.* (Russian)

The sanitary characteristics of water samples taken from mountain creeks along their upper, middle, and lower reaches were investigated. Water samples taken at the upper reaches of creeks excelled in high sanitary quality. Occasional presence of minor traces of DDT and BHC in such samples was observed. Samples from the middle and lower reaches of the streams which flow through rural areas were of inferior quality. Such samples always contained DDT and BHC in concentrations below the maximum allowable level. The presence of DDT and BHC in the water is due to the use of pesticides in agriculture, on pastures, and for the treatment of cattle; the presence of DDT, a pesticide now banned for a few years, was also due to leachout from the soil.

74-2573. Dimitrov, S.; Vuleva, R. (Inst. Biol. and Pathol. of Reproduction and Noninfect. Diseases, Sofia, Bulgaria). **Vurkhu produlzhitelnostta na zadurzhane na tiodana v lyutserna i lyutsernovo seno. [Studies on the persistence of thiodan residues in alfalfa and alfalfa hay.]** *Vet.-Med. Nauki 9(5): 41-46; 1972.* (9 references) (Bulgarian)

Alfalfa was sprayed with thiodan (endosulfan) emulsion at rates of 125 and 150 g/dka. Endosulfan residues in the plants were examined on days 1, 7, 13, 19, 21, and 25 after treatment, and on days 10-45 of storage. Sun-dried and shade-dried alfalfa hay were also examined. Residues were detected up to day 21 in the alfalfa sprayed at the lower rate and day 25 in the case of the alfalfa sprayed with 150 g/dka. Endosulfan residues were detectable even on day 45 in alfalfa hay produced on day 13 after spraying at 125 g/dka. Endosulfan residues disappear more rapidly from sun-dried than from shade-dried alfalfa. (From author summary)

74-2574. Kramer, D.; Schmaland, G. (Institut fuer Wasserwirtschaft, Berlin, DDR). **Pflanzenschutzmittel-Rueckstaende in Gewaessern. Wasserwirtschaftliche Probleme als Folge der Biozidanwendungen. [Herbicide residues in water bodies: problems of water economy as a consequence of the application of pesticides.]** *Wasserwirt.-Wassertech. 24(5): 161-167; 1974.* (26 references) (German)

General problems of water contamination by insecticides, fungicides, and herbicides and their toxicity factors are surveyed. Contamination of water bodies is due to mosquito, pest fish, or weed control, entrainment, drift, penetration, or fall-out. Damages to fish and mussels due to DDT were reported. While organochlorine insecticides are both highly toxic and persistent, organophosphorus preparations are degraded in 0.7 to 28 hr in water. Use of organomercurial fungicides with high ichthyotoxicity in and near water bodies should be avoided. Herbicides usually have low toxicity in fish and degrade rapidly. 2,4-D was degraded by soil microorganisms in water in eight days. The half-life periods for ametryne, terbutryne, and atrazine in water ranged from 11-25 days.

See also 74-2590 74-2605 74-2761

74-2575. Taksdal, G. (Dept. Crop Sci., Makerere Univ., Kampala, Uganda). **The insecticide residue problem in export production of vegetables and fruits in East Africa.** *Acta Hort. (The Hague) 33: 123-129; 1973.* (15 references)

The problem of keeping pesticide residues in export products within the tolerance limits set by the importing countries is troublesome for East African fruit and vegetable growers. There are 70 official recommendations for the use of aldrin, DDT, dieldrin, endosulfan, and lindane and 59 for diazinon, dimethoate, fenitrothion, malathion, and menazon in Kenya, Tanzania, and Uganda. Accepted tolerances of these pesticides are generally lower than the FAO/WHO (1970) recommendations in Germany, Switzerland, and the Netherlands. A practical way to avoid high residue levels in crops is to apply the pesticide sufficiently in advance of crop harvest. The recommended pre-harvest periods for the mentioned pesticides are generally shorter for Kenya than Austria, U.K. and Netherlands except for diazinon where Netherlands accepts application 10 days before harvest. Kenya's period for endosulfan is 3-14 days; for Austria, Netherlands and U.K., it is 35, 28, and 42 days, respectively. Uganda gives only very general advice and Tanzanian recommendations are not currently available. A provisional list of the EEC for thirty pesticides complies with the most severe national restrictions. East Africa should be helped to formulate a satisfactory system of preharvest periods and tolerances based on acceptable scientific investigations.

74-2576. Marinova, G.; Osmankova, D.; Dermendzhieva, L. L.; Khadzhikolev, I.; Chakurova, O.; Kaneva, Ya. (Sci. Res. Inst. Obstetrics and Gynecology, Sofia, Bulgaria). **Pestitsidi i ortrazhenieto im vurkhu vuzproizvoditelnata funktsiya na zhenata. [Professional injuries—pesticides and their effects on the reproductive functions of women working with pesticides.]** *Akush. Ginekol. (Sofiia) 12: 138-140; 1973.* (8 references) (Bulgarian)

The gonadotropic, embryotoxic, and mutagenic actions of pesticides were studied in a survey of 116 female farm workers exposed to organochlorine and organophosphorus pesticides, including DDT. Menorrhagia and hypermenorrhea in 12.9%, and oligomenorrhea were found in 18.1%, compared with the respective incidences of 3.2%, and 6.66% in the control group. There was no significant difference between the test group and the control group with respect to spontaneous abortions, premature deliveries, and fertility. There was no data available on stillbirths, malformations, and infant mortality. Anemia was determined in 31.03% against 10% in the control group; reduced cholinesterase activity in 50.9% against 3.3%; and prolonged Weltman test along with pathological thymol and cadmium tests in 22.64% against 3.3% in the control group.

74-2577. Sim, V. M. (Med. Res. Div., Biomed. Lab. Edgewood Arsenal, MD). **Anticholinesterase poisoning.** *Amer. Fam. Physician 9(5): 146-148; 1974.*

Organophosphate or carbamate poisoning causes a biochemical lesion which can be totally reversed if symptoms are recognized in time and treated appropriately. Symptoms of acute oral ingestion or skin absorption are gastrointestinal disturbances followed by pulmonary and CNS symptoms. Miosis results only from direct contact of the chemical with the eyes. Unilateral miosis caused by rubbing the eye with a contaminated finger has been mistakenly diagnosed as a CNS lesion. Low level chronic exposure results in weakness, loss of appetite, sleeplessness, irritability, and sometimes cramps and diarrhea. There are four general principles of therapy; the order of the first three depends on the patient's condition. Decontamination: the patient must be removed from the toxic atmosphere and washed with copious amounts of water. If gastric lavage is indicated, watch for aspiration pneumonia resulting from solvents used. Oxygenation: mouth-to-mouth, mouth-to-nose, or mouth-to-endotracheal tube may be necessary to overcome airway resistance, followed by ventilators while the patient is watched carefully for signs of respiratory distress. Atropine: 2-4 mg i.v. atropine sulfate should be given (watch pulse and electrocardiogram), repeated if blood pressure drops or if salivation or rhonchi increase. Arrhythmias or ventricular fibrillation can be prevented if adequate oxygenation has been established. Oximes: only after an initial blood sample has been drawn for diagnosis, 2-PAM chloride or pralidoxime chloride (U.S.), 2-PAM methane sulfonate P_2S (U.K. and Commonwealth) or Toxogonin (Europe): 1-2 g in 100 cc dextrose in water should be given over 30 minutes. Discontinue or reduce rate if hypertension results. Morphine or any respiratory depressants should never be given. Diazepam (10 mg) may help in controlling convulsions if several doses of atropine have failed to do so.

74-2578. Holmes, J. H.; Starr, H. G., Jr.; Hanisch, R. C.; Von Kaulla, K. N. (Univ. of Colorado Med. Cent., 4200 E. Ninth Ave., Denver, CO 80220). **Short-term toxicity of mevinphos in man.** *Arch. Environ. Health 29(2): 84-89; 1974.* (20 references)

This is a report of two cases of acute, moderate toxicity to mevinphos. Symptomatology was similar to that previously reported for exposure to parathion or sarin. Excretion pattern for the alkyl phosphate ester dimethylphosphate (DMP) shows rapid excretion that is almost complete 50 hours after exposure to mevinphos. Total excretion of DMP equivalent to 7.7 mg and 9.2 mg, respectively, of mevinphos was measured in two cases. Blood coagulation studies showed marked fibrinolysis in one case and marked hypercoagulability in the other, as demonstrated by the thrombin generation curve. Hematuria persisted in one patient for more than eight days. Both patients responded well to treatment. There was a five- to ten-hour delay between exposure and the patient reporting to the hospital for treatment. (Author abstract by permission)

74-2579. Lande, S. S. (Allegheny County Health Dept., Arsenal Health Cent., Pittsburgh, PA). **An epidemiological study of pesticide exposures in Allegheny County, Pennsylvania).** *Arch. Environ. Health 29(2): 90-95; 1974.* (32 references)

Pesticide incidents reported to the Pittsburgh Poison Center were followed up with a standard interview. Comparison of the statistical evaluation of these interviews with other regional and national studies indicated that the Allegheny County experience is respresentative of accidental pesticide exposures in an urban area. Remarkably high frequencies were observed for children less than 2 years old exposed to attractive formulations, for children of 2 to 5 years exposed to stored products, and for adults exposed during applications. Seasonal differences were also noted. Childhood exposures, especially to rodent and ant baits, were often unnecessarily treated. (Author abstract by permission)

74-2580. Baer, F. (Bundesgesundheitsamt, Max von Pettenkofer Inst., Abt. Toxikol., Berlin-Dahlem, Germany). **Die toxikologische Bewertung (Sicherheitsspannen, Hoechstmengen) im Rahmen des Lebensmittelgesetzes (Lebensmittel-Zusatzstoffe und Pestizidrueckstaende). [The toxicological evaluation (margin of safety, tolerances) for food legislation (food additives and pesticide residues).]** *Arch. Toxicol. 32(1): 51-62; 1974.* (29 references)

The toxicological evaluation of the increasing use of various chemical substances in the food industry, e.g., additives and pesticide residues, supplies rigorous standards of health precautions, with increasing sensitivity of experimental toxicological test methods and appropriate actions to safeguard the consumer. The judgment of safety of a proposed additive or pesticide residue involves consideration of the no-effect levels demonstrated in experimental animals, using an adequate margin of safety and the allocation of acceptable daily intakes (ADIs) for man. These figures are indicators of the toxicity or safety of the respective chemicals and form the basis for the assessment and recommendation of limits of pesticide residues. The difficulties of predicting disease in man caused by chemical substances on the basis of animal experiments are emphasized. (Author abstract by permission edited)

74-2581. Stevenson, J. H.; Walker, J. (Min. Agr. Fish. Food, Agr. Develop. Adv. Serv., Rothamsted Lodge, Harpenden, Herts., England). **Bee poisoning by insecticides in Britain 1966-1973.** *Bee World 55(2): 64-67; 1974.* (10 references)

Samples of honeybees thought to have been poisoned by insecticides are regularly collected and analyzed. A summary is given of all poisoning incidents reported to the Bee Unit of the Agricultural Development and Advisory Service from 1966 to 1973. Treating flowering field beans with systemic organophosphates remains the most serious cause of bee poisoning. Many cases of insecticide poisoning of honeybees could be avoided by not spraying flowering crops or crops containing flowering weeds; using safer formulations (e.g. granules) or safer chemicals where available and suitable; timing insecticide application, following instructions on labels, ensuring cooperation between beekeepers and farmers or contractors over the placing of apiaries and, where possible, moving or closing threatened hives during spraying; and avoiding contamination of equipment by careless use of insecticides.

74-2582. Kaye, S. (Inst. Leg. Med., Sch. Med., Univ of Puerto Rico, Rio Piedras, Puerto Rico). **Changing patterns of poisoning in Puerto Rico.** *Bol. Asoc. Med. P. R. 66(4): 64-66; 1974.* (12 references)

This paper contains statistics on cause of death from poisoning (including suicide and accidental overdose) in Puerto Rico from 1966 to 1972. In 1966, 30 of the 69 poisoning deaths were caused by parathion, 7 by morphine, and 8 by ethanol. Deaths due to morphine rose to 33 (out of 109) in 1971, but dropped to 8 out of 104 in 1972. The number of suicides by parathion has always been higher than those caused by any other single agent (30 out of 69 in 1966, 19 out of 60 in 1967, 28 out of 83 in 1968, 43 out of 130 in 1969, 37 out of 127 in 1970, 33 out of 109 in 1971, with morphine also responsible for 33 deaths in that year). However, in 1972, 20 out of 104 deaths were caused by parathion, and 30 by ethanol. The breakdown of these poisoning deaths by age and sex is also given.

74-2583. Selby, L. A.; Edmonds, L. D.; Stewart, R. W.; Lower, W. R.; Parke, D. W. (Environmental Health Surveillance Cent., Univ. of Missouri, Columbia, MO 65201). **Effects of swine husbandry on the incidence of congenital malformations: a matched pair study.** *Environ. Res. 6: 77-83; 1973.* (11 references)

One hundred case-control herds were evaluated to determine the possible association between congenital malformations and husbandry practices in two subpopulations of Missouri swine. The etiology of the malformations in these populations was thought to be primarily environmental. General geographic environment and herd size, two variables considered to be related to both the exposure (husbandry practices) and disease (congenital malformations), were used in matching the case-control herds. A total of 32 swine husbandry variables including breeding practices, feeding practices, use of drugs, and water source were evaluated. The use of pesticides (classified as insecticides, herbicides, and other pesticides) on animals and/or crops showed a slight negative correlation with congenital malformations. Only five of the variables were significant ($P = 0.10$). This, however, is not considered unusual when 32 variables are tested, even if the null hypothesis is true. Therefore, in the future, environ-

mental studies of swine birth defects may be confined to factors in the natural environment rather than the man-made environment (husbandry). (Author abstract by permission of Academic Press, Supplemented)

74-2584. Meykar, O. A. (Nav. Sea Syst. Command, Washington, DC 20362). **Progress of protection of the environment and resources in the United States—a historical survey.** *IEEE Trans. Aerosp. Electron. Syst. 10(4): 521-532; 1974.*

The State and Federal legislative actions designed to protect and improve the environment in regard to water, air, noise, pesticides, radiation, solid waste disposal, and control of toxic substances such as mercury, beryllium, asbestos, and carcinogens are discussed. The EPA was legally established in December, 1970; by consolidating in the EPA the responsibility for research and standard setting, monitoring and enforcement with regard to all major environmental concerns, recognition has finally been given to the interrelated nature of environmental problems. Included in a 1973 action program was the proposal for research, development and demonstration programs on integrated pest management involving the U.S. Department of Agriculture, the National Science Foundation, and the EPA and conducted by leading universities. Federal encouragement for development of training programs and state certification of crop protection specialists, expansion of the U.S. Department of Agriculture field scqut program to eliminate unnecessary pesticide use, and development of standards by the Departments of Labor and Health, Education, and Welfare under the Occupational Safety and Health Act to protect farm workers from pesticide poisoning are proposed.

74-2585. Schall, E. D.; Hutton, G. L. (Off. Indiana State Chem., Biochem. Bldg., Purdue Univ., West Lafeyette, IN 47907). **The regulation of pesticides.** *Indiana Agr. Exp. Sta. Inspect. Rep. No. 97, 1972, 30 p.*

This report is the first summary of pesticide regulatory activities in Indiana under the 1971 Indiana Pesticide Law. The law is designed to provide safe, effective pesticides which are properly labeled, inspected, and analyzed. All pesticides used in the state must be registered, and this account ensures that a plan can be made for training and supervision of pesticide use. In the law, definition of pesticides and pesticide activities are given as well as procedures for registration, inspection, analysis, cancellation, or suspension of pesticides. The Indiana Pesticide Review Board, consisting of 9 voting and 4 non-voting members representing consumer, conservation, education, and agriculture interests of the state may adopt regulations for classifying, displaying, or packaging pesticides. Section 2 of this report is a list of 483 registered pesticide manufacturers or formulations. In section 3 are results of 300 laboratory analyses of pesticides inspected during 1972.

74-2586. Kraybill, H. F. (Nat. Cancer Inst., Nat. Inst. Health, Bethesda, MD). **The toxicology and epidemiology of natural hepatotoxin exposure.** *Isr. J. Med. Sci. 10(4): 416-425; 1974.* (35 references)

The toxicology and epidemiology of various hepatotoxins of plant, bacterial, viral, and chemical origin are reviewed. Especially in ruminants, excessive copper intakes may result from ingestion of copper-containing fungicides. Certain plant alkaloids contain copper, thus exposing the animal to chronic poisoning. Copper poisoning causes a decreased body weight, an increase in serum activities and, in general, a toxemic jaundice leading to mortality of about 20% in animals at risk in any given year.

74-2587. Le Quesne, P.; Damluji, S. F.; Rustam, H. (Middelsex Hospital, London, WIN 8AA, England). **Electrophysiological studies of peripheral nerves in patients with organic mercury poisoning.** *J. Neurol. Neurosurg. Psychiat. 37(3): 333-339; 1974.* (21 references)

Studies were done on 19 patients, age 5 to 55 years, about 4 months after the onset of symptoms resulting from eating wheat contaminated with methylmercury for a period of about six weeks. Four patients were disoriented, restless, and unable to speak. In nearly half the patients, vision was abnormal, usually consisting of gross constriction of visual fields with preservation of central acuity. Impairment of cerebellar function was the commonest and most disabling abnormality, causing inability to walk and gross slurring dysarthria. Except for four patients who had no sensory symptoms, paresthesias affected the hands and feet, and sometimes the inside of the mouth and the tongue of the remaining patients. Other sensory symptoms were subjective blunting to pin prick, defective appreciation of light touch, defective position sense for fine movements of fingers and toes, and astereognosis. Vibration and temperature sensation were normal in all. However, no electrophysiological abnormality was demonstrated in the peripheral nerves of any patient. The authors suggest that the sensory disturbances are due to CNS damage.

74-2588. Nagi, N. A.; Yassin, A. K. (Dept. Paediat. Physiol., Univ. Mosul Coll. Med., Mosul, Iraq). **Organic mercury poisoning in children.** *J. Trop. Med. Hyg. 77(6): 128-132; 1974.* (13 references)

This report describes the clinical picture of 26 children, age 3-16 years, poisoned by consumption of wheat dusted with methyl mercury during the outbreak in Iraq in 1972. Some type of neurological abnormality was observed in each child, including ataxia, decreased visual acuity, dysarthria, exaggerated tendon reflexes, plantar reflex extensor, tremor, and dilated pupils. Twelve patients had gastrointestinal disturbances including hypertrophy of the gums, anorexia, vomiting, abdominal pain, loose bowels, and dysphagia. There

were no signs related to renal or cardiovascular disturbances. Only one child had exfoliative dermatitis, one had erythematous macular eruption, and two complained of itching. White blood cell counts varied between 300 and 15000/m^3, hemoglobin concentration between 60 and 90% on the Sahli scale; red cells were hypochromic in the majority of blood films. The only abnormality in cerebrospinal fluid of 17 patients tested was elevation of protein content to 40-100 mg-percent. Patients were treated with vitamins B_1, B_6, B_{12}, dimercaprol (BAL), or EDTA. No improvement was seen during one month in the hospital.

74-2589. Doi, R. (Tokyo Metropolitan Res. Inst. Environ. Pollution, Tokyo, Japan). **[On the biological half-life of mercury.]** *Kagaku (Science) (Tokyo) 44(8): 514-515; 1974.* (8 references) (Japanese)

The biological half life (BHL) of mercury is discussed, mainly based on Al-Shahristani's report on the half life of mercury in hairs of 48 Iraqis intoxicated by a methyl mercury pesticide. Although Al-Shahristani reported a BHL of 72 days as the arithmetic mean, there are 154 days between the individual minimum and the individual maximum, 35-189 days. The individual BHL values fall within the range between the min. and max. value according a definite frequency distribution. The statistical method is indispensable for grasping the whole picture, but it is the individuals of lower resistance who are apt to accumulate mercury and must thus be considered in terms of health problems due to intoxication or environmental pollution, rather than the average individual. It would be a great mistake to consider all Japanese mercury accumulation and intoxication problems based on the average BHL of 70 days. Monitoring for maintenance of the ADI of mercury should be based on the maximum value of the BHL in order to prevent any actual risk of intoxication due to mercury. The control of the ADI for methyl mercury in particular should be based on the maximal BHL in brain.

74-2590. Newton, I.; Bogan, J. (Inst. Terrestrial Ecology, Edinburgh, Scotland). **Organochlorine residues, eggshell thinning and hatching success in British sparrowhawks.** *Nature 249(5457): 582-583; 1974.* (9 references)

The relationships between DDT usage, eggshell thinning, and hatching success were studied in British sparrowhawks between 1971 and 1973 using 325 nests and eggs from 130 clutches. In eggs with less than half grown embryos, the main residues were DDE, PCB, and dieldrin. There was no evidence that the residues were metabolized as the embryos developed. Compared with 71 clutches collected in the same general area in 1900-1945, the eggs collected in 1971-1973 showed an 18% reduction in shell index. The shell index was inversely correlated with the logarithm of the DDE concentration and the PCB concentration; it was only poorly correlated with the dieldrin concentration. Thirty-four percent of the nests showed normal hatching success, 31% showed partial success, and 35% failed completely. The hatching success was inversely related to the egg organochlorine content. The primary cause of unsuccessful breeding was failure to lay after having built a nest, which was apparently not recorded in this species prior to 1946. Egg breakage was the second most common cause of failure, breakage in general being related to the degree of shell thinning. The third most common cause of failure was desertion. Once the eggs hatched, the survival of young in all groups was greater than 90%. Clutches failing in all ways except due to desertion had organochlorine levels significantly higher than those showing normal success.

74-2591. Copland, G. M.; Kolin, A.*; Shulman, H. S. (Dept. Anat. Pathol., Sunnybrook Med. Cent., Toronto, Ontario, M4N 3M5, Canada). **Fatal pulmonary intraalveolar fibrosis after paraquat ingestion.** *N. Engl. J. Med. 291(6): 290-292; 1974.* (16 references)

A case of a 39-year-old man who died 26 days after ingestion of a mouthful of paraquat is described. The clinical course was that of renal toxicity that rapidly improved but was followed by progressive respiratory failure. At autopsy, extensive intraalveolar avascular fibrosis was found in all lung sections examined. Demonstration of basal membranes and reticulin confirmed the absence of both interstitial fibrosis and vessel growth. Paraquat, after reaching the ventilated pulmonary alveoli, damages or destroys their epithelial lining. Owing to accompanying renal damage in early stages of paraquat poisoning, toxicity levels may persist for days, thus suppressing any attempts at regeneration of alveolar epithelium. This process allows time for fibroblasts to invade and fill terminal air spaces.

74-2592. Nagata, H.; Izumiyama, T.; Kamata, K.; Takano, S. (Hokushin General Hospital, Nagano, Japan). **[Results of observations on the health status of farmers engaging in mass application of pesticides in a fruit tree growing district for several years.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6):751-753; 1974.* (Japanese)

Results of health examinations since 1965 are reported, especially examinations for potential liver disturbances in operators of speed-sprayers in the apple growing district of northern Nagano Prefecture. Recently applied pesticides include organophosphates, dithiocarbamates, and copper sulfate. The examinations included general condition; hematological, hemobiochemical, and urological studies; and charted medical history. Abnormalities in liver function were predominant, the appearance of abnormal values of serum cholinesterase activity and alkaline phosphatase activity at certain times of the year most common, with sporadic finding of abnormal values of SGOT, SGPT, LAP, and TTT. The next most common finding was slight

reduction in hemoglobin content. However, with the banning of parathion (3 years ago), serum cholinesterase abnormalities have been greatly reduced. The average alkaline phosphatase activity in the operators was not always significantly higher than normal, but it was elevated in many cases. The SGOT values fluctuated, but there was a tendency for distribution in the high normal range. These findings suggest the possibility of liver disturbance among such operators. Many operators and applicators did use protective equipment. Medical examination before and after the pesticide application season is indispensable. (Proceedings of 1st Asian Congress of Rural Medicine, Oct. 24-27, 1973, at Nagano, Japan.)

74-2593. Kudo, N. (Kudo Hospital for Internal Med., Hirosaki, Aomori, Japan). **[The actual condition of intoxication by organophosphorus pesticides in apple growing districts around Hirosaki City, Aomori Prefecture.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 754-755; 1974.* (Japanese)

Blood and neurological examinations were carried out on 133 males and 49 females seven months after the completion of pesticide application. Amounts of 0.004-0.520 ppm of various organophosphorus pesticides were detected including methyl parathion, ethyl parathion, malathion, fenitrothion, salithion, and dichlorvos . According to clinical examinations, 14 cases were diagnosed as chronic intoxication due to organophosphorus pesticides, all patients showing organophosphorus pesticides at more than 0.005 ppm in blood. Thirteen cases showed methyl parathion in blood (in spite of the ban of parathion three years ago). Abnormally higher values of LDH, LAP, and ALP were frequently detected, especially in persons whose blood contained methyl parathion. Two cases of abnormalities in optic nerves were found during fundus examination. Accentuation of patellar reflex and parasympathetic nerve system and less response of ankle jerk reflex were noticed. Symptoms such as miosis, eczema, and facial reddening were frequent. (Proceedings, 1st Congress of Asian Rural Medicine, Oct. 24-27, 1973, Nagano, Japan)

74-2594. Nakazawa, T.; Nakazawa, T. (Yamanashi Prefectural Institute of Environmental Health, Yamanashi, Japan). **[Chronic organophosphorus intoxication in women.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 756-758; 1974.* (Japanese)

Three kinds of obstetric and gynecologic diseases which are apparently correlated with organophosphorus pesticide use were discussed based on 22 years' experience with 40,000 outpatients and 4,000 inpatients. More than 50 cases of prolonged sterility were seen with anemia, abnormal menstruation, or amenorrhea in women who had been heavily engaged in pesticide application. Symptoms disappeared upon changing to less toxic pesticides, treating for anemia, and getting enough rest for a period of 3-6 years. Pregnancy toxemias frequently occurred in 1967 when the season was very dry and the rainfall insufficient to wash away the pesticide residue. Toxemia usually developed 2-4 weeks before delivery and disappeared by two weeks after delivery. Functional uterine bleeding with anemia and weight loss was sometimes seen during the busy agricultural season. The awareness by women of the dangers of pesticides and the banning of parathion may have reduced these three diseases. Menopause occurs sooner in women in the fruit growing district than in non-agricultural women. Examination of 8,000 newborns in the fruit-tree growing district revealed no relationship between congenital anomalies and pesticide application. (Proc. 1st Asian Congress of Rural Medicine, Oct. 24-27, 1973, Nagano, Japan)

74-2595. Michail, G. (Iasi Inst. of Pub. Health and Med., Iasi, Rumania). **[On the preliminary study of occupational chronic exposure in plant protection]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 773; 1974.* (Japanese)

The relationship between the health of a pesticide applicator and pesticide intoxication during application was studied in 256 regularly employed pesticide applicators in four plant protection centers. The most frequently used insecticides were organochlorines, followed by organophosphates and carbamates; these were used singly or in combination. Although the possibility for inhalation and cutaneous absorption of toxic materials has been reduced, the absorption of pesticide is evidenced by the following data: the average content of paranitrophenol in blood was 0.84 mg/l, and the percentage detection of a malathion metabolite in blood and γ-BHC in urine was respectively 100 and 25. The range of residual γ-BHC in urine was 0.08-0.305 ppm. Although serum ChE activity during application was slightly reduced, no case of occupational intoxication was found. In spite of normal results of nonspecific enzymes and biochemical examination, a slight reduction of SH groups was seen in those having 10-15 years occupational history. It was noticed that the value of 17-ketosteroids increased regardless of length of occupation.

74-2596. Matsushima, S.; Sugaya, H. (Author address not given.) **[The present state of pesticide intoxication among pesticide applicators: results of an investigation by the Study Group for Pesticide Intoxication, Japanese Association of Rural Medicine.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 774-779; 1974.* (Japanese)

The results of examinations performed on 563 outpatients claiming pesticide intoxication who visited 55 rural hospitals throughout Japan between 1970 and 1972 were reported. These included 315 men and 248 women, including 129 inpatients; 9.8, 21.0, 26.8, 19.7,

and 11.4 % of the patients, respectively, were in their twenties, thirties, forties, and fifties in age. In 369 cases the symptoms developed during application, in 81 cases not during application, in 29 cases due to misuse and accidental intake, in 73 cases due to suicide attempts, and in 11 cases due to miscellaneous causes. Poisoning was due to organophosphates (OP), herbicides, organosulfur compounds (OS), organochlorines, and antibiotics in 28.4, 16.7, 10.4, 7.8, and 4.4 % of the cases respectively. The most common pesticide injury was dermatitis (48.5 %) due to OP, herbicides, and OS, followed by acute intoxication (40%) by OP, organochlorines, and herbicides, then by keratitis and conjunctivitis due to antibiotics, especially Blasticidin-S. The causes of pesticide intoxication during application included inadequate protective measures (49%), poor health (18%), carelessness (13%), and bad weather (12%). Intoxication not during application was generally attributable to premature entry into treated fields. When the results were compared to those of five years ago, a decrease in acute intoxications and an increase in dermatitis were noticed.

74-2597. Council of Agricultural Materials (Division of Pesticides, Tokyo, Japan). **[A proposal concerning the safety measures of pesticides.]** *Noyaku Bijinesu (Pestic. Business) 157: 1292; 1974.* (Japanese)

A proposal concerning safety measures for pesticides (agricultural chemicals) in Japan was presented to the Secretary of Environment and to the Minister of Agriculture and Forestry by the Council of Materials for Agriculture on April 26, 1974. The proposal required the collaboration of the government in expanding the research and study system for evaluating the safety of pesticides, in promoting the development of new pesticides, and in consolidating the system of safe use of pesticides.

74-2598. Apostol, S.; Gavat, V. (Inst. Med. Farm., Iasi, Rumania). **Considerente igienico-sanitare privind utilizarea pesticidului dipterex. [Health and sanitary considerations on the use of the pesticide dipterex.]** *Rev. Med. Chir. 77: 417-421; 1973.* (26 references) (Rumanian)

Organophosphates are the most widely used pesticides today and account for 30% of the total number of occupational intoxications. Dipterex (trichlorfon), also known as Anthon, Bayer, Chlorophos, Dylox, Muscamor, Neguvon, and by other synonyms, is of moderate toxicity to humans and mammals, but is highly effective. Trichlorfon may be administered directly in sanitary and veterinary medicine. Trichlorfon is rather persistent for an organophosphate; residues can be detected longer than in the case of other pesticides. Trichlorfon inhibits cholinesterase activity, producing cholinergic disturbances; the acute lethal dose for humans is estimated to be about 25 mg. To avoid environmental pollution and to prevent poisoning it is necessary to establish standards for trichlorfon use and to improve nutritional status wherever possible, since proper diet increases resistance to organophosphate poisoning.

74-2599. Anonymous. **EPA proposes standards for pesticide applicators.** *Rice J. 77(5): 23; 1974.*

The Environmental Protection Agency has published proposed standards describing types of knowledge which pesticide applicators will be expected to have in order to qualify as certified applicators under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. The states are responsible for certification, and their standards must meet or exceed EPA's. Under the FIFRA, some pesticides or certain uses may be restricted. Proposed standards for commercial applicators are broader than those for private applicators. It is proposed that commercial applicators be divided into 10 categories, and a person may be certified in one or more, at his option. No level of formal education is required, but commercial applicators should pass a written test, and private applicators would have to be able to read and understand label instructions. State certification plans must be submitted to EPA for approval no later than October 21, 1975.

74-2600. Sivitskaya, I. I.; Alekseychuk, M. S. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pesticides, Polymers and Plastic Materials, Kiev, USSR). **Klinika i sostoyaniye funktsii glaza pri vozdeystvii polikhlorpinena. [Clinical aspects and functional state of the eye under the action of polychloropinene.]** *Vestn. Oftalmol. 2: 74-77; 1973.* (9 references) (Russian)

The functional state of the eye following single, acute exposure to polychloropinene due to violation of the rules of accident prevention was studied in farm workers. Lachrymation and photophobia developed 30-60 min after exposure and were followed by headache, emesis, and blurred vision. Conjunctivitis, the presence of floating turbidity in the vitreous body, edema of the retina, and focal hemorrhage in the retina were observed on the days after exposure. Lability of the diastolic pressure in the central artery of the retina, with tendency toward hypertension, especially in elder subjects, reduced visual acuity, reduced sensitivity of the visual analyzor, and retarded dark adaptation were determined in ophthalmological examinations. Nearly complete restoration of the visual acuity and of the dark adaptation was determined in younger subjects. Polychloropinene was found to have no local and resorptive effect on the functional state of the eye.

74-2601. Utklev, H. E.; Westbye, C. (Author address not given). **Endosulfanforgiftning. [Poisoning with endosulfan.]** *Nor. Vet. Tidsskr. 83(1): 31; 1971.* (Norwegian)

After grazing on a strawberry field sprayed with the prescribed dose of Thiodane 35 (with 35% endo-

sulfan content) 4 days earlier, hogs and two lambs developed unsteady gait and uncontrolled leg movements, followed by complete inability to stand. Contrary to related poisoning tests, no regular cramps were observed. The animals had fairly good appetite and were otherwise in good condition. The animals recovered completely in about one month. The maximum dose they could have ingested was about 5 mg/kg of body weight. Endosulfan is eliminated from the organism relatively rapidly and fails to accumulate therein.

74-2602. Gembitskii, Ye. V.; Uvarov, B. S.; Moshkin, Ye. A.; Levshankov, A. I. (Author address not given). **Lecheniye bol'nykh s ostroy dikhatel'noy nedostatochnost'yu na etapakh meditsinskoy evakuatsii. [Treatment of acute respiratory insufficiency during stages of medical evacuation.]** *Voenno-Med. Zh. 1: 45-50; 1973.* (Russian)

Problems of the treatment of acute respiratory insufficiency of chemical or other etiology during the different stages of medical evacuation are discussed with particular reference to acute respiratory insufficiency caused by organophosphorus compounds. Organophosphates are used as pesticides and chemical warfare agents. Acute respiratory insufficiency is the main symptom of poisoning by organophosphorus compounds such as trichlorfon and parathion. In less serious cases, the bronchial passages are restricted due to spasm and hypersecretion, accompanied by spasms of the respiratory musculature and functional disorders of the respiratory center in serious cases of poisoning. Deep coma and paralysis of the respiratory system are observed in the most serious cases. During the early stage, paralysis of the respiratory system is of CNS origin, while in the later stages, reduction of the contractility of the respiratory musculature due to blockage of the neuromuscular synapses becomes prevalent. Atropinization, administration of cholinesterase reactivators, and especially combinations of the two are most effective in the treatment of acute poisoning by organophosphorus compounds.

74-2603. Moshkin, Ye. A.; Pukach, L. P. (Author address not given). **Promyvaniye zheludka v terapii otravleniy khlorofosom. [Gastric lavage in the therapy of chlorophos poisonings.]** *Voenno-Med. Zh. 3: 42-44; 1973.* (Russian)

Experiences with gastric lavage in acute poisonings by trichlorfon are presented. Early, and especially repeated gastric lavage was found essential for the improvement of the status of the patients and of the outcome of the poisoning. Analyses of the liquids used for gastric lavage for the presence of trichlorfon revealed that in poisonings of medium and especially of high severity, the elimination of the poison was considerably slower than in less serious poisoning, which is due not only to the larger doses involved in serious poisoning, but also to increased absorption of the poison by the gastric mucosa and the reentry of the poison into the stomach from the lower gastrointestinal tract. It was usually possible to eliminate the poison from the stomach after repeated gastric lavage for 1.5 to 12 hours.

74-2604. Dehne, H.; Wozniak, K. D. (Sektion Chemie, Martin-Luther-Universitaet Halle-Wittenberg, Halle, DDR). **Toxische und sensibilisierende Eigenschaften von substituierten Aryl-trichlormethyl-carbinolen. [Toxic and sensitizing properties of substituted aryl-trichloromethylcarbinols.]** *Z. Gesamte Hyg. Ihre Grenzgeb. 19(7): 535-538; 1973.* (17 references) (German)

Three cases of skin sensitization and eczema in laboratory assistants are described following contact with 4-chloro-2-(alpha-hydroxy-beta, beta, beta-trichloroethyl)-phenol and 4,6-dichloro-2-(alpha-hydroxy-beta, beta, beta-trichloroethyl)-phenol. These substances were being synthesized and tested for use as acaricides. Itching, erythema, and development of papillae on the hands and forearms were observed. Rapid normalization of the skin was achieved by antieczematous treatment and elimination of allergen contact. Substituted aryl-trichloromethylcarbinols cause epidermal sensitization in a concentration as low as 0.1%, while a single contact with concentrations of 10% or higher could cause toxic skin damage.

74-2605. Koch, R.; Strobel, K. (Inspektion der Hygiene der Arbeits- und Lebensbedingungen des Bezirkes Gera, Gera, DDR). **Zur Problematik der Festlegung hygienischer Grenzwerte fuer Wasserschadstoffe am Beispiel von DDT und Lindan. [On the problem of fixing hygienically acceptable limits for harmful substances in water, using DDT and lindane as examples.]** *Z. Gesamte Hyg. Ihre Grenzgeb. 20(4): 219-222; 1974.* (5 references) (German)

A possible way of fixing hygienically acceptable limit values for harmful substances is presented, using DDT, its metabolites, and lindane as examples. The criteria used were toxicological aspects, organoleptic properties, basic load, and pesticide elimination by way of water treatment processes in drinking water preparation. The permissible level was calculated on the basis of the no-effect level and the acceptable daily intake as recommended by the World Health Organization. Modifications were made with respect to the possible synergism of several pesticides and considerations that water is only one of the sources of pesticides in humans, and that water is consumed by those with reduced resistance such as children and elderly. The toxicologically substantiated, hygienically acceptable limit values of total DDT and lindane in drinking water, as calculated, are 0.003 ppm and 0.001 ppm, respectively. The limit value, determined from organoleptic criteria, is much higher. In view of the possibility of eliminating DDT and lindane from water (by flocculation with subsequent filtration and by adsorption on activated

carbon, respectively, at efficiencies of over 90% and 84%), the maximum allowable DDT and lindane concentrations are set at 0.03 ppm and 0.01 ppm in water to be treated for drinking.

See also 74-2574 74-2653 74-2665

74-2606. Ohkawa, H.; Hisada, Y.; Fujiwara, N.; Miyamoto, J. (Res. Dept., Pesticides Div., Sumitomo Chem. Co. Takarazuka, Hyogo, Japan). **Metabolism of *N*-(3′,5′-dichlorophenyl)succinimide in rats and dogs.** *Agr. Biol. Chem. 38(7): 1359-1369; 1974.* (17 references)

When *N*-(3′,5′-dichlorophenyl)succinimide (DSI)-carbonyl-^{14}C and -phenyl-^{3}H were each orally administered to rats, regardless of the label site, most of the dose was readily eliminated. There was no difference in the excretion rate between male and female rats. No radioactive residues were detected in tissues and organs 24 hr after dosing. Urinary metabolites consisted of *N*-(3′,5′-dichlorophenyl)succinamic acid (DSA), *N*-(3′,5′-dichlorophenyl)malonamic acid (DMA), *N*-(3′,5′-dichlorophenyl)-2-hydroxysuccinamic acid (2–OH–DSA), and 2–OH–DSA derivatives. In dogs, most of the administered dose was excreted in equal amounts in urine and feces. 2–OH–DSA derivatives were main urinary metabolites and most of fecal radiocarbon was due to intact DSI. The results of this study indicate that DSI is a biodegradable compound which is unlikely to leave any persistent residues in animals. The degradation of DSI to DSA was mediated by an arylamidase-type hydrolase, which was present in the microsomal fraction of rabbit liver. The enzyme activity was found in livers and kidneys of four animal species tested. Depending on the animal species, the enzyme appears to be important for the metabolism of DSI. (Author abstract by permission)

74-2607. Rashid, M.; Mayaudon, J. (Lab. Biochim. Microbienne, Fac. Sci. Agron., Univ. Louvain, 3030-Heverlee, Belgium). **Effect of carbamates and anilines on *Pseudomonas putida* and soil microbial activity.** *Ann. Microbiol. (Paris) 125 A (2): 193-200; 1974.* (13 references)

One hundred ppm of IPC (propham), CIPC (chlorpropham), diuron, fenuron, monuron, SN 3812 (3-methoxycarbonylaminophenyl)-*N*-3-carbanilate, SN 38584 (3-methoxycarbonylaminophenyl-*N*-3-methylcarbanilate), SN 38574 (3-ethoxycarbonylaminophenyl-*N*-3-methylcarbanilate), SN 38210 (methyl-*N*-3-hydroxycarbanilate), SN 38078 (ethyl-*N*-3-hydroxycarbanilate), aniline, 3-chloroaniline, 4-chloroaniline or 3,4-dichloroaniline were incubated for 18 hours with fresh sandy loam and the influence on soil microflora determined by radiospirometry. Soil respiration was inhibited about 50% with chlorpropham and monuron; 15-50% with propham, SN 38210, SN 38078, and 3-chloro- and 4-chloroaniline; and not at all with SN 38574, SN 38584, SN 38212 and aniline. 3,4-Dichloroaniline caused 35% inhibition. *P. putida* inoculated to sterilize loamy sand was inhibited 50% by propham, SN 38210, and 3,4-dichloroaniline. Chlorpropham, monuron, diuron, fenuron, SN 38584, SN 38574, SN 38212, and aniline had no effect. Propham, SN 38210, SN 38078 caused 30-40% inhibition. *P. putida* grown in vitro was inhibited by aniline but not by 3,4-dichloroaniline.

74-2608. Davison, K. L.; Sell, J. L. (U. S. Dept. of Agr., Agr. Res. Serv., Metabolism and Radiation Res. Lab., Fargo, ND 58102). **DDT thins shells of eggs from mallard ducks maintained in ad libitum or controlled feeding regimens.** *Arch. Environ. Contam. Toxicol. 2(3): 222-232; 1974.* (14 references)

Mallard ducks were fed diets containing various levels of technical DDT or chemically pure *p,p′*-DDT, or dieldrin. Either technical DDT or *p,p′*-DDT at 20 ppm or greater, or dieldrin at 10 ppm caused a statistically significant reduction in eggshell thickness, weight, and calcium. Shells of eggs from ducks fed 40 ppm of *p,p′*-DDT were about 20% thinner than those from control ducks, and shells of eggs from ducks fed 10 ppm of dieldrin were about 6% thinner than those from controls. The reduction in eggshell thickness was linear with increasing dose of DDT to 40 ppm, and with increasing dose of dieldrin through all levels studied. Eggshell thinning occurred regardless of whether the diets containing DDT were fed under ad libituum or controlled conditions. DDT fed at 200 ppm was lethal to the ducks. Neither DDT nor dieldrin affected weight of the eggs or rate of egg production. (Author abstract by permission)

74-2609. Guthrie, F. E.; Domanski, J. J.; Main, A. R.; Sanders, D. G.; Monroe, R. R. (North Carolina State Univ., Raleigh, NC 27607). **Use of mice for initial approximation of reentry intervals into pesticide-treated fields.** *Arch. Environ. Contam. Toxicol. 2(3): 233-242; 1974.* (30 references)

The possibility of using laboratory mice to obtain information relative to establishment of reentry intervals for pesticide-treated fields was investigated. Pre- and postexposure blood cholinesterase levels of mice exposed for 10 hours to insecticide-treated (field applications) tobacco, cotton, or apple leaves were determined at 24 hour intervals. Differences were found between insecticides with respect to both initial inhibition and residuality as well as different types of foliage, rates of application, and formulation. (Author abstract by permission)

74-2610. Villeneuve, D. C.; Phillips, W. E.; Panopio, L. G.; Mendoza, C. E.; Hatina, G. V.; Grant, D. L. (Food Res. Lab., Foods Directorate Health Protect. Branch, Tunney's Pasture, Ottawa, Ontario, Canada). **The effects of phenobarbital and carbon tetrachloride on the rate of decline of body burdens of hexachlorobenzene in the rat.** *Arch. Environ. Contam. Toxicol. 2(3): 243-252; 1974.* (11 references)

Male and female rats were raised from weaning on diets containing 0, 20, and 40 ppm of hexachloro-

benzene (HCB) for three months. The animals were then placed on an HCB-free diet and dosed with either sodium phenobarbital or carbon tetrachloride. Animals were killed at 0, 15, and 30 days on the HCB-free regimen and tissue residues determined. Plasma cholinesterase activity was depressed by carbon tetrachloride treatment as were liver aniline hydroxylase and *N*-demethylase activities. Phenobarbital treatment increased liver aniline hydroxylase and *N*-demethylase activities. HCB decay profiles were established for plasma, fat, and liver. No direct correlation was observed between induction of enzyme activity and rate of disappearance of HCB residues in liver tissue. (Author abstract by permission)

74-2611. Gupta, P. K.; Paul, B. S. (Ind. Toxicol. Res. Cent., Lucknow, India). **Effect of malathion on oxygen consumption and blood cholinesterase of the hen.** *Arch. Environ. Health 29(3): 167-169; 1974.* (11 references)

The effect of malathion on oxygen consumption by liver and kidney slices and on cholinesterase enzyme (ChE) of plasma and red blood cells (RBC) has been investigated in hens. Single oral doses of 262.40 and 393.60 mg/kg (equivalent to 50% and 75% of the LD50 respectively) resulted in an initial rise of plasma cholinesterase followed by a fall. The RBC cholinesterase on the other hand was significantly inhibited right from the beginning. The plasma enzyme activity recovered earlier returning to almost normal values in six to eight days while the RBC enzyme continued to be significantly inhibited even after ten days. Six hours after a single oral dose of malathion the oxygen consumption by liver slices was significantly inhibited, and inhibition persisted up to 36 hours. Thereafter, it gradually returned to normal values in the next 36 hours. No change in oxygen consumption by kidney slices was observed. (Author abstract by permission)

74-2612. Karzel, K.; Tauberger, G.; Ayertey, E. K. (Pharmakol. Inst., Univ. Bonn, Germany). **Elektrolytgehalt des Blutes sowie der Herz- und Skelettmuskulatur bei der akuten experimentellen Cyanidvergiftung. [Electrolyte content of blood, myocardium, and skeletal muscle in acute experimental cyanide poisoning.]** *Arch. Int. Pharmacodyn. Ther. 209(2): 259-272; 1974.* (26 references) (German)

Development of effective therapy for cyanide intoxication, which sometimes occurs during crop fumigation, requires improved understanding of the mechanisms of cyanide damage. The effect of intravenous injections of NaCN on K^+ content of blood plasma and on K^+ and Na^+ content of heart and skeletal muscle of anesthetized cats was studied. Repeated doses of 0.35 mg/kg and single doses of 1.4 or 8 mg/kg NaCN caused a statistically significant hyperkalemia which was associated with pronounced functional cardiovascular changes. The K^+ and Na^+ content of skeletal muscle remained unchanged in all cases. In animals dying after the injection of 1.4 mg NaCN/kg, the K^+ content of the heart was significantly reduced (from 110.8 to 100.9 mEq/l. fiber water; $p < 0.05$). The injection of 8.0 mg NaCN/kg caused a reduction of the K^+ content and, in addition, an increase of the Na^+ content of heart muscle (from 23.3 to 32.0 mEq/l fiber water; $p < 0.001$). The results indicate that in acute cyanide intoxication the K^+ concentration gradient in the heart can be considerably reduced due to a decrease in the intracellular K^+ content. This diminution of the K^+ concentration gradient may be the main cause of the disorders of heart and circulation caused by NaCN. (Author abstract by permission, supplemented.)

74-2613. Domsch, K. H.; Paul, W. (Inst. Bodenbiol., Forschungsanst. Landwirt., Braunschweig, Germany). **Simulation and experimental analysis of the influence of herbicides on soil nitrification.** *Arch. Microbiol. 97(4): 283-301; 1974.* (51 references)

The effect of 35 herbicides on the nitrification process was tested both by experiment and by simulation of possible mechanisms of inhibition in a mathematical model. The model consists of nine equations with six coordinated constant and seven measurable parameters (or initial values), depending on the specific soil. The only free parameters are the initial values of the oxidative enzyme systems, and the parameters which determine the course of possible inhibition effects. For the majority of herbicides, the inhibitory effects on the NH_4+ or NO_2- oxidation were found negligible in the range of practical application. Hypotheses of a completely reversible or partially reversible inhibition of the oxidase systems gave the best correspondence between the model and reality, while an alteration of the growth parameters of the nitrifying populations in the model (death rate, proliferation rate, initial kill) due to the application of herbicides led to strong contrasts between simulated and experimental curves. Significant inhibitory effects became evident only when the hydrogen ion concentration in the soil fell below pH 7. Results with several herbicides indicated that the process of NO_2- oxidation was more sensitive than that of NH_4+ oxidation. With a number of herbicides, an accumulation of NO_2- ions was noticed during the course of soil percolation. In consideration of the buffering capacity, the model is applicable to other soils. (Author abstract by permission)

74-2614. Stonard, M. D.; Nenov, P. Z. (Biochem. Mech. Sect., M.R.C. Toxicol. Unit, Med. Res. Counc. Lab., Carshalton, Surrey, England). **Effect of hexachlorobenzene on hepatic microsomal enzymes in the rat.** *Biochem. Pharmacol. 23(15): 2175-2183; 1974.* (21 references)

Short term feeding of the fungicide, hexachlorobenzene, to rats causes a marked increase in hepatic

cytochrome P-450 levels, enhancement of the activities of several in vitro microsomal oxidations, diminished pharmacological actions of hexobarbitone and zoxazolamine in vivo. Chronic feeding of rats with hexachlorobenzene leads to a diminished pharmacological action in vivo of zoxazolamine but not hexobarbitone in male rats; in contrast to the male rat, there is a diminished pharmacological response to hexobarbitone in vivo in the female rat. The concentration of cytochrome P-450 in the liver remains elevated throughout the chronic feeding of hexachlorobenzene. The findings suggest that hexachlorobenzene is an inducer of the phenobarbitone class, but there is a qualitative difference between phenobarbitone and hexachlorobenzene with regard to microsomal enzyme induction. (Author abstract by permission)

74-2615. Vaverkova, S.; Vancova, A. (Inst. Agrochem. Technol., Bratislava-Predmestie, Czechoslovakia). **Cytologicke a morfologicke zmeny v korienkoch *Vicia faba* pod vplyvom trifluralinu. [Cytological and morphological changes in the roots of *Vicia faba*, influenced by trifluralin.]** *Biologia (Bratislava) 28(7): 563-569; 1972.* (9 references) (Czech)

Cytochemical and morphological changes produced by trifluralin in roots of *Vicia faba* were studied. Trifluralin retarded the growth of both the primary roots and the lateral roots. After a 3-hour application of a 0.001% solution of trifluralin solution, c-metaphases appeared in the root cap. Later on, cells with chromosomes destroyed and cells with multipolar spindles were noticed. After exposure for 12 hr, polyploid cells appeared at the metaphase stage. Polynuclear cells or such with lobed nuclei were found in the interphase. In those sites where the control plants began to develop lateral roots, the roots treated with trifluralin began to develop thicker, round formations which contained several times larger number of chromosomes. The latter blackened and finally fell off.

74-2616. Dwernychuk, L. W.; Sheppard, D. H.; Halley, L. E. (Dept. of Biol., Univ. of Saskatchewan, Regina, Saskatchewan, Canada). **Mergamma DB and phenylmercuric acetate: their effect on the reproduction of Japanese quail (*Coturnix coturnix japonica* Temminck and Schlegel).** *Can. J. Zool. 52: 291-300; 1974.* (17 references)

A commercial seed fungicide-insecticide, Mergamma DB, and one of its constituents, phenylmercuric acetate, were fed to Japanese quail (*Coturnix coturnix japonica*) in the laboratory. Five levels of mercury (1.25, 2.50, 12.50, 25.00, and 50.00 ppm) mixed with laying meal were fed to birds during four 16-week experiments. Survival of female quail, egg production, and egg weight were significantly reduced at 50 ppm mercury (Mergamma DB as mercury source). Fertility, embryo viability, and hatchability were each significantly reduced at levels of 12.5 ppm mercury for both mercury compounds. Results showed that the Mergamma DB treatments produced more pronounced reproductive failure than phenylmercuric acetate. Breast muscle from treated birds and egg contents contained significantly higher levels of mercury residue than in control birds, up to a maximum of 8.9 ppm in tissue and 2.3 ppm in eggs. Accumulation of mercury in male birds may have contributed to the significant decline in fertility of treated birds. Possible serious environmental implications of mercury seed treatments are discussed. (Author abstract by permission)

74-2617. Teruya, A.; Higashi, T. (Dept. Biochem., School Pharm. Sci., Showa Univ., Tokyo, Japan.) **Differential effect of 3-amino-1,2,4-triazole on multiple forms of rat liver catalase.** *Chem. Pharm. Bull. 21(4): 840-845; 1973.* (17 references)

Male rats were injected intraperitoneally with 3-amino-1,2,4-triazole (amitrole) at 100 mg/g body weight and the liver catalase assayed at intervals afterward. Within 2 hours, enzyme activity had fallen to 1-2% of controls, then it gradually rose to normal over a period of 3 days. However, catalase protein measured immunochemically remained constant after injection. Soluble liver catalase (catalase II) decreased to a minimum within one hour, but returned to normal on the third day. Soluble catalase is more susceptible to amitrole than catalase in the peroxisomes (catalase III), and it also recovers more rapidly from inactivation. The author suggests that the difference in behavior of the two catalases may be partly explained on the basis of their different localization within the cell, the soluble enzyme being more readily accessible to the injected amitrole.

74-2618. Leadem, T. P.; Campbell, R. D.; Johnson, D. W. (Biol. Dept., Idaho State Univ., Pocatello, ID 83201). **Osmoregulatory responses to DDT and varying salinites in *Salmo gairdneri*–I. Gill Na-K-ATPase.** *Comp. Biochem. Physiol. 49A (1): 197-205; 1974.* (29 references)

DDT inhibited activity of Na-K-ATPase and Mg-ATPase in gills of rainbow trout (*Salmo gairdneri*) adapted to fresh water (FW), 1/3 sea water (1/3SW) and SW. A negative correlation was found between gill Na-K-ATPase (decrease) and serum sodium (increase) in treated fish in SW. Enzyme activity was inhibited in FW fish, but no osmoregulatory impairment was found. This may indicate a minor or nonexistent role for gill Na-K-ATPase in FW osmoregulation. Enzyme activity was inhibited in trout acclimated to SW (SW>1/3SW>FW). (Author abstract by permission)

74-2619. Cheymol, J.; Chabrier, P.; Thuong, N. T.; Thizy, A.; Demozay, D.; Pillon, D. (Inst. de Pharmacol.,

Fac. de Med., Paris, France). **Toxicites comparees (Mammiferes, Insectes, Acariens) de nouveaux derives trisubstitues de l'acide thiophosphorique. [Comparative toxicity in mammals, insects, and acarids of new trisubstituted derivatives of thiophosphoric acid.]** *C. R. Acad. Sci. Paris Ser. D 277(21): 2425-2426; 1973.* (2 references) (French)

The acute toxicity and the insecticidal and acaricidal activity of trisubstituted derivatives of thiophosphoric acid containing alkoxy, thioalkyl, alkyloxy, and amino radicals were studied in albino mice, *Sitophilus granarius, Musca domestica, Anagasta kuhniella,* and *Tetranychus urticae*. High toxicity of amide-substibuted derivatives and low toxicity of ester-substituted derivatives in mice following i.p. administration were determined. The i.p. LD50 values determined for mice range from 0.4 to 1,187 mg/kg.

74-2620. Deysson, G.; Thizy, A.; Negulesco-Rubingher, I. (Laboratoire de Biologie Cellulaire, Fac. des Sciences Pharmaceutiques et Biologiques, Paris, France). **Etude ultrastructurale comparee de la cytotoxicite de divers herbicides ureiques et de composes apparentes. [Comparative ultrastructural study of the cytotoxicity of various urea herbicides and derivatives.]** *C. R. Acad. Sci. Paris Ser. D 278(13): 1723-1726; 1974.* (3 references) (French)

The cytotoxicity of various urea herbicides and urea derivatives was studied in *Allium sativum* L. roots. Urea and *N,N*-dimethylurea had very low cytotoxicity, with LD values (minimum lethal concentrations in 24 hr) being over 1 g %. The LD values for *N*-phenylurea, *N*-chloro-3 phenylurea, monuron, benzomarc, diuron, methoxymarc, and neburon were between 0.1 and 1 g %, while 3,4-dichloraniline, 3,4-dichloro-*N*-phenylurea, and 3,4-dichloro-*N*-phenyl-*N'*-methylurea had LD values below 0.1 g %. Dichloroaniline had the highest cytotoxicity. Diuron, benzomarc, methoxymarc, *p*-butoxy benzoyl monuron, 3-chloro-*N*-phenylurea, 3,4-dichloro-*N*-phenylurea, and 3,4-dichloro-*N*-phenyl-*N*-methylurea caused ultrastructural changes characteristic of neburon (dilated, ameboid proplasts, and slightly deformed mitochondria). 3,4-Dichloro-aniline and 3,4-dichloro-*N*-phenyl-*N*-methylurea produced ameboid proplasts, small, hardly differentiated mitochondria, and strong proliferation of the endoplasmatic reticulum. The nonchlorinated derivatives 3-isopropyl-*N*-phenyl-*N*-dimethylurea and 3-*tert*-butyl-*N*-phenyl-*N*-dimethylurea caused elongation and strong deformation of the mitochondria, while urea, *N,N*-dimethylurea and *N*-phenylurea produced vacuolization and fragmentation of the endoplasmic reticulum without any change in the mitochondria and proplasts.

74-2621. Petrella, V. A. (Virginia Polytech. Inst. and State Univ., Blacksburg, VA). **Metabolism studies of endrin in endrin-susceptible and resistant pine mice.** *Diss. Abstr. Int. 35(1): 98B; 1974.*

In vivo and in vitro studies were performed on the metabolic fate of endrin in susceptible and resistant pine mice. One major fecal metabolite, F-1, was produced by both strains. Three urinary metabolites, U-1, 2, and 3, were produced by the S strain, but only U-1 and 2 were observed in R urine. When the strains were dosed at equal levels, the R strain eliminated twice as much of the administered endrin as F-1 and U-2 compared to the S strain. Under chronic dosing at equitoxic levels, endrin elimination in the form of F-1 accounted for the same percentage of the dose in the two strains. U-1 was excreted in nearly identical quantities by all treatment groups. Endrin was metabolized in vitro by hepatic microsomes from both mouse strains solely to a form designated as L-1. Production of L-1 is enzymatic and NADH-dependent. R microsomes displayed increased ability for L-1 production compared to the S microsomes. F-1, U-2, and L-1 (each representing the major metabolite of the respective type) were all identical to the *anti* isomer of 12-OH-endrin. U-1 was tentatively considered to represent one of four possible tertiary alcoholic forms of endrin, and U-3 one of two possible cyclic hemiketal configurations. Differences in endrin metabolism between R and S strains may be related to the mechanism of resistance. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-14,501.)

74-2622. Abo-Khatwa, A. N. (Purdue Univ., Lafayette, IN). **The effect of formamidine derivatives and other pesticides on mitochondrial function.** *Diss. Abstr. Int. 35(1): 297B; 1974.*

In preliminary tests, 47 pesticidal chemicals were examined for their effects on energy-linked functions of rat liver mitochondria in vitro. Nine of these were active at low concentrations ($< 10^{-6}$ *M*) as general inhibitors or uncouplers of phosphorylating respiration: chlordimeform, U-36,059 fentin acetate, Mon-0858, Banamite, and a metabolite of iodofenphos. The mode of action of chlordimeform is unknown. It exerted uncoupling activity similar but not identical to that of 2,4-dinitrophenol. Uncoupling activity in a variety of species was site specific: coupling sites I and II of respiratory chain phosphorylation were more sensitive than site III. The uncoupling activity of chlordimeform was reversed by BSA addition or by washing. Chlordimeform reversed the normal inhibition of state 3 respiration by oligomycin and atractylate, both specific energy transfer inhibitors. The Hansch pi constant was highly significant as a predictor for the uncoupling activity of analogous formamidines. The MAO-inhibiting action of formamidines was relatively weak. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-15,113.)

74-2623. Johannsen, F. R. (Univ. of Missouri, Columbia, MO). **Toxicological studies of fluenethyl acaricide.** *Diss. Abstr. Int. 35(2): 871B-872B; 1974.*

The metabolism and action mechanism of FlU (fluenethyl) were investigated in the mouse, housefly, and twospotted spider mite. FlU-^{3}H equivalents were eliminated at a moderate rate in mouse urine and feces following intraperitoneal injection of acaricide. Metabolites identified in urine included biphenylacetic acid, 2- and 4-hydroxybiphenyl, and 4,4'-dihydroxybiphenyl; biphenyl and 3,4-dihydroxybiphenyl were tentatively identified. Biphenylacetic acid and hydroxylated biphenyls occurred in mouse urine in the free form and as glucuronides and/or ethereal real sulfates. FlU was degraded enzymatically by subcellular fractions from mouse liver homogenate and nonenzymatically by a model hydroxylation system. Metabolites from house flies and spider mites were qualitatively identical to but quantitatively different from those produced by the mouse. Human, mouse, sheep, and pig plasma catalyzed FlU degradation, primarily to biphenylacetic acid; formation of the latter was inhibited by DFP. Monofluoroacetic acid, monofluorethanol, and FlU were the most toxic of the monofluoroethyl esters and analogs tested to mice, flies, and mites; poisoning produced the classical organofluorine symptoms. Ethanol, isoniazid, triazole, acetamide, sodium acetate, and monoacetin afforded some protection against the toxicity of FlU and monofluoroethanol to mice, suggesting that metabolic activation is necessary. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-18,558.)

74-2624. Coleman, M. B. (Louisiana State Univ. and Agr. and Mech. Coll. Baton Rouge, LA) **The effect of carboxin on Complex II from beef heart mitochondria.** *Diss. Abstr. Int. 35(2): 949B; 1974.*

The effect of carboxin on intact and disrupted beef heart and rat liver mitochondria was determined in respirometry studies with tricarboxylic acid (TCA) cycle intermediates as substrates. Carboxin specifically inhibited succinate oxidation. No carboxin inhibition of activity was detected using phenazine methosulfonate (PMS) assays and intact beef heart mitochondria, thus ruling out inhibition at the level of the succinate dehydrogenase flavin moiety. Carboxin inhibited formazan formation by intact mitochondria and by succinate-coenzyme Q reductase, as well as dichlorophenol-indolphenol (DCIP) and ferricyanide reduction by succinate-coenzyme Q reductase. This indicates that the carboxin site of action corresponds to complex II of the electron transport system. DCIP was reduced in the absence of coenzyme Q, whereas no activity was observed using the neotetrazolium or ferricyanide assays without added coenzyme Q. Thus, the site of inhibition of carboxin is on one or both of the iron-sulfur proteins located within complex II of the electron transport system. EPR studies confirmed these observations. Structure-activity studies of carboxin derivatives revealed that all substitutions in the carboxin molecule decrease its inhibition of succinate-coenzyme Q reductase. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-18,324).

74-2625. Morris, J. E. (Univ. of Missouri, Columbia, MO). **Effects of dieldrin on reproduction in raccoons.** *Diss. Abstr. Int. 35(2): 1129B; 1974.*

The effects of dieldrin on the fertility and fecundity of captive raccoons were studied from September, 1968, through June, 1970. Raccoons were fed a control or a 2 ppm dieldrin treated diet. Experimental groups on each of the diets consisted of 10 juvenile males, 10 juvenile females and 10 adult females. Young male raccoons on the dieldrin treated diet showed delayed sexual maturation and lower fertility. During the seventh month active spermatogenesis was apparent in 5 of 10 control males but in only 1 of 10 treated males. The percentage of viable sperm was significantly higher in control (72.9%) than treated males (51.3%). The mean dieldrin load in thigh muscle was 0.8 ppm after 21 months on the dieldrin diet. Treated females exhibited abnormal estrous cycles, reduced ovulation rates, increased resorption of embryos and higher adult mortality. Eight of 20 females died after the eighteenth month on the experimental diet. Dead embryos and uteri from treated females that had a normal estrous cycle had higher dieldrin residues than those females which did not have a normal estrous cycle. Both uteri and embryos accumulated dieldrin. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 74-18,603).

74-2626. Harrison, S. D., Jr.; Bosin, T. R.; Maickel, R. P. (Dept. Pharmacol., Med. Sci. Program, Indiana Univ., IN). **Metabolism of 3-(2-dimethylaminoethyl)-benzo(b)thiophene in vitro and in vivo in the rat.** *Drug Metab. Disposition 2(3): 228-236; 1974.* (34 references)

Liver microsomes from adult male Sprague-Dawley rats were incubated with 3-(2-dimethylaminoethyl)-benzo(b)thiophene (I) and the metabolites identified by high resolution NMR and mass spectrometry. In a second experiment adult male Sprague-Dawley rats were injected with ^{3}H-I and the urine and feces collected for analysis; samples of plasma, liver, kidney, and brain were also analyzed. The results of the two experiments indicated that the major pathways by which I is metabolized are 6-hydroxylation, *N*-dealkylation, and oxidation by monoamine oxidase. No evidence for sulfoxidation was obtained. The in vitro metabolites of I were 3-(2-dimethylaminoethyl)benzo(b)thiophene (82.5%); 6-hydroxy-3-(2-dimethylaminoethyl)benzo(b)-thiophene (8.5%); 3-(2-methylaminoethyl)benzo(b)-thiophene (4.8%); and benzo(b)thiophene-3-acetic acid (4.2%). In the in vivo studies 45% of the injected dose was excreted in the urine in 96 hours. Radioactivity was not concentrated in the brain, liver, kidney, or plasma at 96 hours.

74-2627. Matthews, H. B.; McKinney, J. D. (Nat. Inst. Environ. Health Sci., P.O. Box 12233, Res. Triangle Park, NC 27709). **Dieldrin metabolism to *cis*-dihydroaldrindiol and epimerization of *cis*- to *trans*-dihydroaldrindiol by rat liver microsomes.** *Drug Metab. Disposition 2(4): 333-340; 1974.* (20 references)

^{14}C-dieldrin was incubated with rat liver postmitochondrial supernatant and NADPH. At 0, 10, 20, 40, and 80 minutes the incubations were stopped by extraction with ether, and the extracts were concentrated under a stream of nitrogen and co-chromatographed in 2 dimensions on thin-layer plates with synthetic *cis*-4,5-dihydroxy-4,5-dihydroaldrin (CAD). When total radioactivity in each spot was measured, CAD spots consistently contained more radioactivity than background samples. No radioactivity was associated with CAD-spots incubated with ^{14}C-dieldrin and boiled enzyme. When synthetic CAD was incubated with rat liver homogenate, extracted and gas chromatographed, it was shown that epimerization to the trans-isomer had occurred; 75% of this epimerase activity is in the microsomal and cytosol fractions, and it requires NADPH and cytochrome P-450, but not molecular oxygen. If the epimerization reaction is not specific for CAD, it may explain why dihydrodiol metabolites of most cyclic compounds excreted by mammals have *trans*-configuration.

74-2628. Miyamoto, S. (Nat. Inst. of Animal Ind., Min. Agr. and Forestry, Chiba, Japan). **[Distribution and excretion of mercury (^{203}Hg) administered as phenyl mercury (^{203}Hg) acetate (PMA) in lactating guinea pigs and its transfer into the sucklings.]** *Eiyo To Shokuryo (Food Nutr.) 27(3): 109-115; 1974.* (25 references) (Japanese)

PMA (^{203}Hg) of specific activity of 50 μCi/mg, was administered once at the rate of 500 μg/animal p.o. in a capsule to six lactating guinea pigs of the Hartley strain. Another five lactating guinea pigs received the same dose once a day for five consecutive days. The excretion of Hg into feces and urine, the transfer of Hg into milk, the residue of Hg in some organs and blood, and the transfer into sucklings from mother's milk were traced radiochemically. Most of the Hg in PMA administered p.o. was excreted via feces (59.7% single dose and 61.7% repeated dose) and urine (13.2% and 16.4%). While the transfer of Hg into milk was small (0.40% for both) it continued during the entire experimental period of 11 days. The amount and concentration of mercury residues were highest in kidney (8.5-14.8%, 9.4-28.1 ppm), followed by liver (2.4-2.8%, 0.24-1.5 ppm), and then by other organs. A small amount of Hg was detected in brain. The transfer of Hg from milk to the sucklings was 4.8% for the single dose and 5.07% for the repeated dose. The period in which half the amount of administered Hg was excreted was about two or three days.

74-2629. Dyer, R. D.; Born, G. S.; Kessler, W. V. (Bionucleonics Dept., Purdue Univ., West Lafayette, IN 47907). **The distribution of intraperitoneally injected cadmium-115m in chickens.** *Environ. Lett. 7(2): 119-124; 1974.* (20 references)

Six three-month-old female Leghorn chickens were given weekly i.p. injections containing Cd-115m-labeled cadmium acetate at an average weekly dose of 0.01 mg/kg body weight. Animals were sacrificed three weeks after the last injection and cadmium distribution studied. Liver, kidney, pancreas, and spleen had 0.90, 1.88, 0.61, and 0.30 percent of whole body cadmium/g. About 0.1% whole body cadmium appeared in each egg laid after the injection, with activity distribution being about 80% in the yolk, 15% in the white, and 5% in the shell. Eggs showed no difference in percentage of whole body activity or in distribution of cadmium when comparisons were made between first and last eggs laid.

74-2630. Metcalf, R. L. (Author address not given). **A laboratory model to evaluate compounds producing biological magnification.** *Essays Toxicol. 5: 17-38; 1974.* (22 references)

A laboratory screening system for potential new synthetic organic chemical products is proposed. The development of a laboratory system for the evaluation of micropollutants is discussed in terms of a laboratory model ecosystem, radiolabeled compounds for investigation, the operation of the model ecosystem, and interpretation of the results. The model ecosystem technology is applicable to the investigation of the principles of biodegradability of DDT analogs, determination of the biodegradability of candidate pesticides, study of the insecticides chlorpyrifos and chlorpyrifos methyl, and the investigation of micropollutants other than pesticides. Although no two model ecosystems are alike, the results obtained using the proposed technology are highly reproducible.

74-2631. Morgan, D. P.; Roan, C. C. (Author address not given). **The metabolism of DDT in man.** *Essays Toxicol. 5: 39-97; 1974.* (95 references)

The disposition of the DDT ingested by man was studied, along with the kinetics of the biochemical and physiologic processes involved. Eight volunteer subjects, including the authors, participated in the investigation. The processes studied included: the absorption and storage of ingested DDT; the chemical conversion of DDT to DDE, DDD (TDE), and DDA; the disposition of the metabolites of *p,p'*-DDT; the relationship between the blood concentrations of DDT isomers and metabolites and the adipose stores of these chemicals; and the loss of fat-stored DDT, DDE, DDD, and DDA.

74-2632. Yaksh, T. L.; Fedele, L. A.; Yamamura, H. I. (Med. Res. Div., Biomed. Lab., Edgewood Arsenal, Aberdeen Proving Ground, MD 21010). **Recovery of cholinesterase activity in the cerebrospinal fluid, brain-**

stem and plasma of the unanesthetized cat after irreversible cholinesterase inhibition. *Experientia 30(1): 38-39; 1974.* (14 references)

Cats were pretreated with atropine methyl nitrate and one hour later injected s.c. with 27 μg/kg of soman (27 μg/ml) or an equal volume of saline. The activity of cholinesterase (ChE) was then measured in daily samples of cerebrospinal fluid (CSF), plasma, and brainstem. After soman administration, the CSF-ChE fell rapidly to 3.9% of the baseline level and remained significantly depressed through the first 48 hours. The plasma ChE also fell rapidly (to 5.8% baseline) and remained below control levels for the next three days, and the brainstem ChE levels fell to 13.5% of baseline. The time required for apparent recovery of 50% baseline values was 0.9 days for CSF, 2.2 days for plasma, and 4.5 days for brainstem. The levels of protein in the CSF and plasma were not significantly affected by soman treatment. No free soman was present in the samples at the time of assay. The data indicates that the recovery of ChE enzyme in the CSF is much more rapid than that of the brainstem and that it does not reflect the relative state of recovery of the brainstem cholinesterase.

74-2633. Alid, G.; Valdes, L. F.; Orrego, F. J. (Dept. Physiol. Biophys., Fac. Med., Univ. Chile, Casilla 6524, Santiago-4, Chile). **Strychnine as an anticholinesterase: in vitro studies with rat brain enzymes.** *Experientia 30(3): 266-268; 1974.* (28 references)

Strychnine at concentrations higher than 10^{-5} *M* competitively inhibited the action of rat brain acetylcholinesterase on 3 m*M* acetylbetamethylcholine. The Km of the enzyme for this substrate is 2.3×10^{-4} *M* and the Ki was 7×10^{-5} on a Lineweaver-Burk plot. Cholinesterase incubated with 3 m*M* butyrylcholine (Km for butyrylcholine : 6.6×10^{-4} *M*) was competitively inhibited by strychnine at a concentration of 10^{-3}. The Ki in this case was 1.3×10^{-4} *M*. With both enzymes, low strychnine concentrations consistently enhanced enzyme activity i.v. 0.2 mg/kg strychnine reduced IPSPs for spinal motor neurons. If the assumption is made that strychnine is only distributed in the extracellular fluid space, the maximal concentration it could reach at this dosage is 3×10^{-6} *M*, more than one order of magnitude less than the Ki of the acetylcholinesterase strychnine complex. It does not, therefore, appear feasible to attribute to this anticholinesterase activity of the drug its mechanism of action when acting in low doses.

74-2634. Shilina, V. F. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pesticides, Polymers and Plastic Materials, Kiev, USSR). **Vliyaniye lindana na soderzhaniye serotonina v korvi i tkanyakh belykh krys. [Effect of lindane on the serotonin level in the blood and tissues of rats.]** *Farmakol. Toksikol. (Moscow) 36(6): 687-688; 1973.* (3 references) (Russian)

The acute and chronic effect of lindane on the serotonin levels was studied in the blood and tissues of albino rats. When administered through gastric tube in a daily dose of 34 mg/kg of body weight for two consecutive days, lindane increased the serotonin level by 140% in the blood and by 90% in the liver and decreased it by 200% in the duodenum, by 33% in the brain, and by 18% in the kidneys. After administration of daily 1.7 mg/kg doses for 10 days lindane reduced the serotonin level in the kidney and caused an increase by 20% in the liver, by 38% in the blood, and by 42% in the brain. After administration of this dose for 90 days, the serotonin level considerably increased in all organs but not in the blood. Definite tendency toward normalization of the serotonin levels in the organs and an increase by 67% in the blood were observed after administration of lindane for 180 days.

74-2635. Proskuryakov, M. T. (Dept. Biol. Chem., Kuban Red Army Inst. Med., Krasnodar, USSR). **Vliyaniye fosfororganicheskikh veshchestv na proteoliticheskiye fermenty in vitro. [The action of organophosphorus substances on the proteolytic enzymes in vitro.]** *Farmakol. Toksikol. (Moscow) 37(2): 238-239; 1974.* (7 references) (Russian)

The action of trichlorfon and nibufin (paranitrophenyl ester of di-*n*-butylphosphinic acid) on the proteolytic enzymes, pepsin and chymotrypsin, was studied in vitro at different pH values. Both organophosphorus substances inhibited chymotrypsin but did not affect pepsin in alkaline medium. At pH 2, and in the presence of excess inhibitor, the chymotrypsin activity was inhibited partially, while the inhibition was total in neutral and alkaline media. Equimolar concentrations of trichlorfon and nibufin failed to inhibit chymotrypsin at pH 7, but the inhibitory effect was significant at pH 9.

74-2636. Ward, P. F. V. (Dept. Biochem. Agr. Res. Counc., Inst. of Anim. Physiol., Babraham, Cambridge, CB2 4AT, England). **Metabolism of fluoroacetate by lettuce.** *Fluoride 6(4): 194-203; 1973.* (13 references)

Fifteen to 20% of applied radioactivity was expired as CO_2 in lettuce plants treated with carbon-14-labeled sodium acetate (1 mg/kg wet weight). This was unaffected by preincubation with labeled sodium fluoroacetate (50 mg/kg). Only 0.5% radioactivity was expired as CO_2 in plants treated by fluoroacetate alone. Citrate is, on the average, about twice as high after incubation with fluoroacetate than with acetate. Ethanol-water extraction of ^{14}C-fluoroacetate treated plants showed that almost all the radioactivity was associated with acidic material, mainly as unchanged fluoroacetate, but about 2% of applied dose as fluorocitrate. Fluorine was entirely extracted into ether under acidic conditions. Between 50 and 90% of fluorine added as fluoroacetate was inorganic. Endogenous fluorine was 3% of the fluorine added as fluoroacetate. All metabolized fluoroacetate, except for the small amount of fluorocitrate,

had undergone scission of the C-F bond and elimination of fluorine as fluoride. Examination of radioactive substances on Amberlite IR-120 (H) cationic-exchange columns showed that metabolites eluted much more slowly than fluoroacetate and fluorocitrate. Metabolites were resolved into four fluorine-free components, one of which was *S*-carboxymethylcysteine and another possibly *S*-carboxymethylglutathione.

74-2637. Buffa, P.; Guarriero-Bobyleva, V.*; Costa-Tiozzo, R. (Inst. di Chim. Biol. Della Univ. di Modena, Via Campi, 287, 41100-Modena, Italy.) **Metabolic effect of fluoroacetate poisoning in animals.** *Fluoride 6(4): 224-247; 1973.* (53 references)

This paper reviews various aspects of sodium fluoroacetate (FAC) metabolism and includes some new findings. Within four hours after i.p. injection, ^{14}C-fluorocitrate was found in the following rat tissues in descending order of concentration: brain, liver, heart, kidneys, stomach and intestine, lungs, spleen, testes, and carcass. Three percent was transformed into fluorocitrate in all cells whose respiration is supported mainly by pyruvate. Fluorocitrate inhibits the TCA-cycle enzyme aconitate hydratase. Fluoroacetate poisoning also causes accumulation of citrate; increased concentrations of ketones in blood and urine; increased blood and liver lactate; a rapid fall in liver and muscle glycogen and increase in glucose; and marked lowering of ATP in liver, skeletal muscle, and heart without uncoupling of oxidative phosphorylation. Mitochondria from various tissues were variously affected in their ability to oxidize pyruvate and L-malate, citrate, succinate, β-hydroxybutyrate, and L-glutamate. Liver and kidneys were greatly affected while brain appeared not to be at all affected. Mitochondrial matrix became transparent to electrons, matrix space expanded, and mitochondria became swollen.

74-2638. McCollister, S. B.; Kociba, R. J.; Humiston, C. G.; McCollister, D. D.; Gehring, P. J. (Chem. Biol. Branch, Dow Chem. U.S.A., Midland, MI 48640). **Studies of the acute and long-term oral toxicity of chlorpyrifos (*O,O*-diethyl-*O*(3,5,6-trichloro-2-pyridyl) phosphorothioate).** *Food Cosmet. Toxicol. 12(1): 45-61; 1974.* (4 references)

The acute and long-term toxicity of orally administered chlorpyrifos (*O,O*-diethyl-*O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate), a broad-spectrum insecticide, has been determined. No sex or strain differences in acute oral toxicity were detected using two strains of rat, and LD50 values determined in several tests ranged from 118 to 245 mg/kg. LD50 values (in mg/kg) for other species were approximately 2000 for rabbits, 504 for guinea-pigs, and 32 for leghorn chicks. Rats and dogs were maintained on diets providing doses of 0.0, 0.01, 0.03, 0.1, 1.0, or 3.0 mg chlorpyrifos/kg/day. ChE activity in plasma and red cells was reduced in rats receiving 3.0 or 1.0 mg/kg/day. ChE activity of the brain of rats was depressed by a dose of 3.0 mg/kg/day. In dogs, ChE activity in plasma was depressed by the 3.0, 1.0, and 0.1 mg/kg/day doses and that in red cells by the 3.0 and 1.0 mg/kg/day doses. Brain ChE was slightly depressed in dogs receiving the highest dose. In the long-term study, no clinical evidence of induction of cholinergic activity was observed in either species at any time. Depression of ChE activity was readily reversible when the control diets were substituted for diets containing chlorpyrifos. No significant effects related to treatment were observed in rats or dogs receiving any dose of chlorpyrifos, using the following criteria: mortality, body weights, food intake, hematological studies, urine analyses, clinical chemistry studies, organ weights and organ to body weight ratios, tumor incidence, and gross and histopathological examination of tissues. It was concluded that 0.1 and 0.03 mg chlorpyrifos/kg/day fed in the diet for 2 yr produced no significant toxicological effect in rats and dogs, respectively. Even in animals receiving 3.0 mg/kg/day, no effects were observed other than a reversible depression of cholinesterase activity. (Author abstract by permission)

74-2639. Polyak, N. R. (Inst. Hyg. Toxicol. Pesticides, Polymers and Plastic Materials, Kiev, USSR). **Immunoserologicheskiye i immunotsitologicheskiye reaktsii pri sensibilizatsii nekotorymi pestitsidami. [Immunoserological and immunocytological reactions in response to sensitization with some pesticides.]** *Gig. Tr. Prof. Zabol. 5: 14-17; 1974.* (9 references) (Russian)

The use of certain immunological reactions (degranulation of mast cells, degranulation of basophils, agglomeration of leukocytes, and blast transformation of lymphocytes) for the specific diagnosis of allergic reactions to such pesticides as trichlorfon, polychloropinene, hexachlorane (BHC), and DDT was studied in vitro and in trials in patients sensitized to these pesticides due to occupational exposure. Trichlorfon, polychloropinene, hexachlorane, and DDT were used in the respective concentrations of 0.5%, 1%, 0.33%, and 0.07% in petroleum ether. All immunological reactions were positive in the in vitro tests under the conditions of antigen-antibody formation. The application of the same tests in subjects sensitized to these pesticides was both specific and positive (the respective percentages of the positive reactions in allergic subjects were 56±10.5% for mast cell degranulations, 69± 3.7% for basophil degranulation, 46.6 ± 3.4% for leukocyte agglomeration, and 90.9 ± 0.86% for lymphocyte blast transformation, against the corresponding percentages of 0, 16.6±2.2, 8±2.3 and 0% in the control group). The findings indicate the suitability of these immunological reactions in the specific diagnosis of allergic reactions due to pesticides.

74-2640. Mandzhgaladze, R. N.; Vashakidze, V. I.; Geradze, L. N.; Gvineriya, I. S. (Inst. Ind. Hyg. Occupat-

ional Diseases, Tbilisi, USSR). **Nekotoryye voprosy vozdeystviya ftalana na organizm teplokrovnykh. [Some questions of the effects of ftalan on warm-blooded animals.]** *Gig. Tr. Prof. Zabol. 5: 50-51; 1974.* (7 references) (Russian)

The acute, subacute, and chronic toxicity of parenterally administered ftalan (folpet) was studied in albino rats, albino mice, and rabbits. The acute LD50 values were 7,540 ± 876.3 mg/kg in rats, 1,546 ± 120 mg/kg in mice, and 1,115 mg/kg in rabbits. The threshold dose was 200mg/kg. Higher doses caused functional troubles in the nervous system, anemia, leukopenia, prolongation of the hyperglycemic reaction, and reduced hippuric acid excretion in the urine in the acute experiment. Doses up to 300 mg/kg had no gonadotoxic effect. Doses of 35, 25, 20, and 10 mg/kg, corresponding to the respective total doses of 280, 200, 160, and 80 mg/kg in a subacute experiment, retarded the embryonic development but caused no fetal death or teratogenesis when administered to rats during the first or second weeks of pregnancy. In a 6-month chronic experiment 50, 35, and 25 mg/kg doses caused reduced hemoglobin level in the blood, leukopenia, reduced hippuric acid excretion, and reduction of the prothrombin time. The cumulation coefficient was determined as 13.5 in rats and 8.2 in mice. The findings indicate that ftalan is a low-toxicity, embryotropic pesticide.

74-2641. Umeda, M.; Saito, M.; Inui, N.; Yamada, M.; Oono, H.; Matsushita, H. (Lab. of Tissue Culture, Fac. of Med., Yokohama Municipal Univ., Yokohama, Kanagawa, Japan). **[Toxicity screening of environmental polluting chemicals in cell cultures.]** *Igaku No Ayumi (Progr. Med.) 90(7): 393-400; 1974.* (5 references) (Japanese)

The concentration inhibiting growth by 50% and the degree of disturbance at 100 μg/ml-0.32 ml for various chemicals were tested on HeLa S-3 and fetal hamster cell cultures. Carcinogenic and non-carcinogenic aromatic hydrocarbons, related compounds, salts of heavy metals, mycotoxins, and pesticides such as DDT, technical-BHC, α-, β-, and γ-BHC, endrin, kelthane, nicotine sulfate, malathion, thiometon, Estox, methoxyethyl mercury chloride, and Miruton were examined. The toxicity values obtained for pesticides in the present study did not coincide with the carcinogenicity findings on rats and mice. Organophosphorus pesticides were highly toxic to HeLa cells. Miruton was hardly toxic to HeLa cells, but was highly toxic to hamster cells, suggesting the existence of a Miruton-activating enzyme (*N*-hydroxylase) only in hamster cells.

74-2642. Zamfir, G.; Raileanu, L.; Avadanii, R.; Dragomirescu, A. (Inst. Ssan. Publ. Cercet. Med., Iasi, Rumania). **Modificari biochimice ale unor doze subletale de Tetradifon. [Biochemical changes due to sublethal doses of Tetradifon.]** *Igiena 21(11): 665-670; 1972.* (18 references) (Rumanian)

The new acaricide, tetradifon, was studied in sublethal doses on rats (200 mg/kg body weight) and fish (2 mg/liter of water). The animals used in the experiments did not show clinical abnormalities; only biochemical changes were observed. Some enzyme levels increased in the rats due to changes in permeability of cells and subcellular units. Aldolase, transaminase, and phosphatase increases were significant. The decrease in cholinesterase was difficult to explain; only organophosphates and carbamates were previously considered active in this respect. The two energy-producing processes were also impaired in rats and fish: uncoupling of the P/O ratio and a decrease in glycolytic capacity were seen as a result of the functional and structural cellular disturbances.

74-2643. Rumsey, T. S.; Samuelson, G.; Bond, J.; Daniels, F. L. (Agr. Res. Serv., Nutr. Inst., Ruminant Nutr. Lab., Beltsville, MD 20705). **Teratogenicity to 35-day fetuses, excretion patterns and placental transfer in beef heifers administered 4-*tert*-butyl-2-chlorophenyl methyl methyl-phosphoramidate (Ruelene).** *J. Anim. Sci. 39(2): 386-391; 1974.* (13 references)

Three trials were conducted to study teratogenicity, placental transfer, and excretion of Ruelene (crufomate) in beef heifers. In the first trial, 32 Angus heifers in the 35th day of pregnancy were injected with saline or 19.4 mg Ruelene/kg heifer weight in the jugular vein or 5 to ten times greater/kg estimated fetus weight into the amniotic sac. Fetuses taken by cesarean section at 180 days of gestation were anatomically normal, and weight and length were not influenced. One fetus in the Ruelene-intravenous group was dead and partly mummified, but anatomically normal, and one fetus from the saline-amniotic sac group and one from the Ruelene-intravenous group were normal except for slight depressions in the forehead. In the second trial two nonpregnant Angus heifers were placed in collection crates for nine days. On the 3rd day they were given orally a gelatin capsule containing 3,200 μCi ^{14}C-Ruelene, and urine, feces, respired CO_2 and blood samples were collected at intervals. Highest plasma radioactivity was 8 hours after administration. A minor amount was in the CO_2 and only 10% in feces; 62% was excreted in the urine in 24 hours. The total amounts of radioactivity were 86.6 and 82.0%. In the third trial, 4 heifers at 180 days of gestation were each injected via a coaxial jugular cannula with 100 μCi ^{14}C-Ruelene. Fetuses were delivered at 180 days. Ruelene or its metabolites or both were transferred across the placental barrier, but the fetus was apparently protected from a large part of the maternal dose because of rapid metabolism and excretion by the mother.

74-2644. McLeese, D. W. (Dept. of the Environ., Fish. and Mar. Serv., Biol. Sta., St. Andrews, N.B., Canada). **Olfactory response and fenitrothion toxicity in**

American lobsters (*Homarus americanus*). *J. Fish. Res. Bd. Can. 31(6): 1127-1131; 1974.* (13 references)

In test runways the olfactory response of American lobsters (*Homarus americanus*) to cod muscle extract is not affected by simultaneous presentation of fenitrothion at measured concentrations ranging from 0.05 to 25.4 ppb at time of stimulation. Larval and adult lobsters have similar sensitivity to fenitrothion. For both, the 96-hr LC50 is about 1 ppb. The lethal threshold for larvae is about 0.015 ppb, that for adults is 0.3 ppb or lower. (Author abstract by permission)

74-2645. Judy, J. C.; Scardino, P. L. (Dept. Urol., Memorial Med. Cent., Savannah, GA). **Adrenal cortical carcinoma: a case report.** *J. Med. Ass. Ga. 62: 377-379; 1973.* (13 references)

In 1949 it was discovered that DDD (TDE) causes necrosis and atrophy of the adrenal cortex in dogs, thus depressing functional ability. In 1952 it was found that *o,p'*-DDD is less toxic and 20 times more active, causing degenerative changes in the zona reticularis and zona fasciculata. Treatment of a middle aged white woman with *o,p'*-DDD following palliative surgery for an advanced case of adrenal cortical carcinoma is described. An intial dose of 1 gram was given followed by an equivalent amount four times daily. This was gradually increased to 2.5 g four times daily, which had to be adjusted because of gastrointestinal distress. Four months after the start of chemotherapy, the patient was readmitted to the hospital with dehydration and weakness. She was in electrolyte imbalance but normotensive. Her condition deteriorated, and she died.

74-2646. Jones, G.; Butler, W. H. (MRC Toxicol. Univ. Med. Res. Council Labs., Carshalton, Surrey, England). **A morphological study of the liver lesion induced by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in rats.** *J. Pathol. 112(2): 93-97; 1974.* (15 references)

Male and female Porton rats were treated orally with 200 μg/kg of dioxin dissolved in DMSO or Arachis oil. At weekly intervals for 10 weeks thereafter, their livers were examined by light and electron microscopy. Parenchymal cell necrosis in the centrilobular zone and mononuclear cell infiltration were evident after one week. Prominent features of this lesion included multinucleate parencyhymal cells and mural fibrosis of the central veins. Evidence indicated that the multinucleate cells were formed by a coalescence of parenchymal cells. Ultrastructurally, extensive fusion of the parenchymal cell plasma membranes in the centrilobular zone was evident. The toxic effect of dioxin on these membranes indicates a specific subcellular site of action for this pesticide.

74-2647. Kuba, K.; Albuquerque, E. X.*; Daly, J.; Barnard, E. A. (Dept. Cell Biol. Pharmacol., Sch. Med., Univ. Maryland, Baltimore, MD 21201). **A study of the irreversible cholinesterase inhibitor, diisopropylfluorophosphate, on time course of end-plate currents in frog sartorius muscle.** *J. Pharmacol. Exp. Ther. 189(2): 499-512; 1974.* (32 references)

Diisopropylfluorophosphate (DFP) reduced the amplitude, shortened the time course by 50%, and shifted the equilibrium potential of the end-plate current (EPC) to more negative values in frog sciatic nerve-sartorius muscle preparations. In the presence of DFP, the half decay time of the EPC was much less potential-dependent than in controls. Washing the muscle in normal Ringer solution caused partial recovery of the EPC amplitude and a 2-fold increase in half decay time. After tetanic stimulation, the first five EPCs were augmented, and following EPCs declined gradually in amplitude by about 60%. Washing did not change this effect. The half decay time and EPC amplitude were restored to almost control values after treatment for 30 minutes with pyridine-2-aldoxime methiodide to dephosphorylate inhibited sites and after washing. EPC decay followed a 2-step exponential function in the presence of DFP, which returned to a 1-step exponential function similar to controls but with a larger time constant after washing prior to pyridine-2-aldoxime methiodide treatment. Membrane potential and spike activity were not affected at concentrations used (1.1 *M*). The authors propose that DFP acts on cholinesterase and on the ionic conductance modulator for the EPC and that acetylcholine interaction with its receptor sites has a much faster time course than that of the resultant conformational changes in the ionic conductance modulator.

74-2648. Dahlgren, R. B.; Linder, R. L. (Iowa Coop. Wildlife Res. Unit, I.S.U., Ames, IA 50010). **Effects of dieldrin in penned pheasants through the third generation.** *J. Wildl. Manage. 38(2): 320-330; 1974.* (12 references)

In 1968 and 1969, single capsules containing lactose or lactose and dieldrin were given weekly to pheasants (*Phasianus colchicus*); hens received 0, 6, or 10 mg and cocks received 0, 4, or 6 mg. Offspring of these birds were bred in 1969 and 1970, and offspring of second generation birds were bred in 1970 and 1971. Direct mortality occurred in breeders at all levels of dieldrin administered, but weights of breeders were not affected by dieldrin. Egg production, fertility, hatchability, viability of chicks at hatching, and weights of chicks from 4 to 6 weeks of age exhibited no relationship to treatment, and were erratic among groups and years. Survival of chicks to 4, 5, or 6 weeks of age was affected ($P < 0.01$) by dieldrin administered to hen parents; offspring of second- and third-generation hens did not differ in survival in relation to treatment ($P > 0.05$). Offspring of parents given dieldrin chose the deep side of a visual cliff more often than control chicks ($P <$

0.05), as did their progeny in the second and third generations. Offspring of parents given dieldrin were more easily caught by hand ($P < 0.01$); this effect was also found in the second and third generation. Behavior, both on the visual cliff and in response to hand catching, was generally most affected where both parents or ancestors had been given dieldrin, and less, but still affected, where either parent or ancestor had been given dieldrin. A genetic mechanism may have been involved in effecting aberrant behavior patterns. (Author abstract by permission)

74-2649. Snyder, R. L. (Inst. of Animal Behav., Dept. of Psychol., Utah State Univ., Logan, UT 84322). **Effects of dieldrin on homing and orientation in deer mice.** *J. Wildl. Manage. 38(2): 362-364; 1974.*

Deer mice were trapped, marked, and assigned to test groups; the experimental animals were injected intraperitoneally with 5 mg/kg of technical dieldrin in corn oil. Animals were carried to a release point 250 m south of the center of the trapping plot 4 hr after injection. Before release, preferred orientation directions were examined via the times spent in each arm of an 8-arm maze. Recapture data were obtained on the original trapping plot. Differences between groups in the orientation test were significant; the control animals spent significantly more time in the three arms of the maze pointing toward the capture plot, while no orientational bias was apparent in the dieldrin group. Within 8 days of release, 11/15 of the control mice had been recaptured, but only 6/15 of the dieldrin-treated mice. LD50 values for dieldrin have not yet been determined in deer mice. Three of four deer mice injected with dieldrin at 20 mg/kg and observed for overt intoxication for 36 hours exhibited only some facial and limb tremors. The experimental mice in the present study tolerated 5 mg/kg injections without apparent toxic symptoms.

74-2650. Ito, T.; Miyake, Y. (Res. Inst. of Environ. Pollut., Kinki Univ., Osaka, Japan). **[Influence of pesticides on enzymes in living bodies.]** *Kinki Daigaku Hokai Kenkyusho Kenkyu Hokoku (Annu. Rep. Res. Inst. Environ. Pollut. Kinki Univ.) 1: 5-8; 1973.* (6 references) (Japanese)

BHC and aldrin-dieldrin in olive oil were administered p.o. to mice at 0.25 and 0.1 mg/kg/day, respectively, for 34 weeks. Three animals were sacrificed each week and enzyme levels examined in homogenates of livers, kidneys, and brains. Weight gain was suppressed by BHC and dieldrin to about half that in controls. The ratio of liver weight to body weight showed less conspicuous changes in BHC and aldrin treated animals than in controls, probably because of accumulation of fats through the action of pesticides in addition to the suppression of weight gain. SGOT showed two peaks in 14 weeks in the BHC and dieldrin groups; SGPT was not affected by BHC or aldrin. The liver GPT and GOT followed the trend of the serum GOT in the BHC and dieldrin groups. Kidney alkaline phosphatase fluctuated in all groups and showed no specific changes due to the pesticides. Kidney acid phosphatase showed two peaks in BHC and aldrin groups. Of the cholinesterases in blood, liver, and brain, the liver cholinesterase in dieldrin and BHC groups showed conspicuous decreases after the nine weeks of treatment, and the brain cholinesterase in pesticide treated groups showed fairly large fluctuations.

74-2651. Ogawa, E.; Suzuki, S.; Tsuzuki, H.; Kawajiri, M.; Kito, H. (Sch. of Pharmacol., Fac. of Med., Gumma Univ. Maebashi, Gumma, Japan). **[Studies on the distribution and excretion of ^{203} Hg-phenyl mercury acetate administered to animals.]** *Kitakanto Igaku (Kitakanto Med. J.) 24(1): 57-64; 1974.* (26 references) (Japanese)

A small amount of ^{203} Hg-phenyl mercury acetate (^{203}Hg–PMA) (μCi/0.1 ml) was administered orally, intraperitoneally, or subcutaneously to adult male ddN-strain mice. The retention, distribution, and excretion of ^{203} Hg were investigated radiochemically for three days. The biological half-life was short, about one-two days in all cases. The daily excretion was usually larger in feces than in urine. The retention after 1 hr of intraperitoneal administration was highest in kidney, attaining a peak after 4 hr. After 1 hr the distribution was in the order kidney > pancreas > blood > liver > spleen > brain, and after 24 hr the order was kidney > liver > other organs. The subcellular distribution of ^{203} Hg in liver and kidney was larger in the supernatant fraction than in other fractions. The effect of acceleration of excretion of ^{203} Hg by administration of BAL, once a day for three days after the administration of PMA, was found in kidney, liver, pancreas, spleen, and blood. BAL caused a concentration of ^{203} Hg in brain.

74-2652. Koshinaka, T.; Sekiguchi, Y.; Kobayashi, N. (Agr. Chem. Inspection Sta., Min. of Agr. and Forestry, Kodaira, Tokyo, Japan). **[Toxicity of probenazole and matsukemin.]** *Kongetsu No Noyaku (Agr. Chem. Mon.) 18(8): 66-69; 1974.* (Japanese)

Information on some recently registered pesticides is outlined. Among them, the acute toxicity of probenazole, a fungicide against rice blast, and that of matsukemin, a formulation of insecticidal *Dentrolimus spectabilis* cytoplasmic polyhedrosis virus, were abstracted herein. LD50 of technical probenazole is 2,750 and 2,220 mg/Kg p.o. to male and female mice, 2,160 and 2,310 mg p. o. to male and female rats, respectively. Its TLm (48 hr) for young carp is 6.3 ppm. LD50 of matsukemin is very large and presumed to be larger than 3,200 mg/Kg p.o. to mice and rat (corresponding to 3.3×10^{10} polyhedrosis virus). Its TLm could not be obtained; no carp died within 48 hr with 10^3 -10^6 polyhedrosis virus/ml.

74-2653. Crocker, J. F. S.; Ozere, R. L.; Rozee, K. R.; Digout, S. C.; Hutzinger, O. (Dalhousie Univ., Dept. of Pediat. and Microbiol., and Nat. Res. Council, Halifax, Nova Scotia, Canada). **Insecticide and viral interaction as a cause of fatty visceral changes and encephalopathy in the mouse.** *Lancet 2(7871): 22-24; 1974.* (20 references)

Solutions of corn oil (group I), DDT (II), commercial fenitrothion (III), or DDT and fenitrothion (IV) were applied to 48 hours old Swiss white mice for 9 days. Two days later the mice were injected with a known titer of mouse encephalomyocarditis virus (EMC). Mortality rates in the 10-day period following virus injection were 0% in group I, 6-17% in group II, 4-9% in group III, and 33-60% in group IV. The disease of the mice in group IV was not identical to EMC lethality alone and was one of rapid CNS deterioration with convulsions and respiratory arrest. The authors suggest a possible parallel between this and Reye's syndrome, a disease of non-specific encephalopathy and fatty visceral changes occurring in children living in the vicinity of forest-spraying operations.

74-2654. Stevens, J. T. (Dept. Pharmacol., Milton S. Hershey Med. Cent., Pennsylvania State Univ. Coll. Med., Hershey, PA 17033). **The role of binding in inhibition of hepatic microsomal metabolism by parathion and malathion.** *Life Sci. 14(11): 2215-2229; 1974.* (31 references)

Parathion, malathion and their oxygenated analogs bind to the reduced form of cytochrome P-450 from rats and mice producing spectra with a maximum at 421 nm and a minimum at 450 nm. Determinations of microsomal heme suggest that the Soret at 421 nm is not associated with conversion of cytochrome P-450 to cytochrome P-420. In vivo pretreatment with C^{14}-parathion indicates that this insecticide covalently binds to mouse hepatic microsomal protein. These findings suggest that the mechanisms by which these insecticides and their analogs inhibit hepatic microsomal metabolism are identical to their mode of inhibiting esterases, that is, covalent binding to catalytic site. (Author abstract by permission)

74-2655. Witschi, H. P.; Kacew, S. (Dept. Pharmacol., Fac. Med., Univ. Montreal, Montreal, Quebec, Canada). **Studies on the pathological biochemistry of lung parenchyma in acute paraquat poisoning.** *Med. Biol. 52(2): 104-110; 1974.* (21 references)

The purpose of this study was to find biochemical parameters which could indicate toxic damage to lung parenchyma. I.p. administration of 50 and 60 mg/kg paraquat dichloride to male Sprague Dawley rats rapidly produced signs of toxic lung damage. Lung surface showed brown-reddish or plum colored spots. Lungs were usually heavier than normal; large and smaller vessels and especially capillaries were engorged with blood. Twenty-four hours after administration, total lung protein had increased, thus diluting aryl hydrocarbon hydroxylase (AHH). Differences in total lung AHH activity between treated and control animals were not significant. Conversion of glucose to CO_2 by lung homogenate and incorporation of radioactivity of glucose into total lung lipids was somewhat depressed in treated animals. At 50 and 60 mg/kg, paraquat decreased MAO activity. No differences were found between treated and control animals for lung RNA and protein synthesis, uridine kinase, ATPase, and cytochrome c reductase.

74-2656. Eranko, L.; Eranko, O. (Dept. Anat., Univ. Helsinki, Helsinki, Finland). **Histochemical observations on enzymatic hydrolysis of acetyl-, butyryl- and propionylthiocholine by rat sympathetic ganglion.** *Med. Biol. 52(2): 111-120; 1974.* (39 references)

Formaldehyde-fixed frozen sections of rat superior cervical ganglion were studied histochemically after cholinesterase reactions with acetylthiocholine, butyrylthiocholine or propionylthiocholine as substrates and tetra-isopropylpyrophosphoramide (iso-OMPA, schradan) or 1,5-bis-(4-allyldimethylammoniumphenyl)-pentan-3-one diiodide (BW 284 C 51) as selective inhibitors. When all conditions were the same, the strongest histochemical reaction was always obtained using propionyl thiocholine as substrate; a similar but somewhat weaker reaction with acetylthiocholine and a far less intense reaction with butyrylthiocholine. Though the intensity differed, reactions after preincubation and incubation with iso-OMPA were similar with all three substrates, localized in the cytoplasm of the nerve cell bodies and in the nerve fibers between them. However, reaction with butyrylthiocholine occurred only after the pH was increased to 6.5-7.0. Distribution after preincubation and incubation with BW 284 C 51 was similar for all three substrates, localized in interstitial tissue, with only an occasional nerve cell body strongly reactive. Intensity again was in order of propionyl-, acetyl- and butyrylthiocholine. It is concluded that the three compounds can serve as substrates for specific and non-specific cholinesterases in rat sympathetic ganglion. Propionyl-thiocholine is readily hydrolyzed, and non-specific cholinesterase is present in presumably the nerve fibers and synapses.

74-2657. Kononovich, N. G. (Ukr. Sci. Res. Inst. Meat Milk Ind., USSR). **Ruynuvannya khlororganichnikh pestitsidiv drizhdzhami. [Destruction of organochlorine pesticides by yeasts.]** *Mikrobiol. Zh. 35(5): 625-628; 1973.* (7 references) (Ukrainian)

The destruction of DDT and BHC in milk and milk products by yeasts of the *Saccharomycetaceae* family commonly used in the dairy industry was studied. The DDT and BHC concentrations in the milk were 0.02, 0.1, 0.2, and 0.4 mg/liter. The BHC and DDT residues

remaining in the milk after growing yeasts for 24 hr ranged from 20% to 50%. Inverse relationship between the pesticide concentration and the rate of destruction was established. Kefir yeast in milk containing 0.02, 0.1, 0.2, and 0.4 mg DDT per liter decomposed 100%, 80%, 70%, and 50% of the total DDT, and the same yeast in milk with the same concentrations of BHC decomposed 100%, 80%, 60%, and 40% of this pesticide. All known yeasts destroyed organochlorine pesticides in milk, using them as a source of carbon.

74-2658. Kuroda, K. (Headquarters for Environmental Protection Measures, Hokkaido Fish. Ass. Abashiri, Hokkaido, Japan). **[Survival abilities of salmon fry in the presence of pesticides.]** *Mizu Shori Gijutsu (Water Treat. Technol.) 15(8): 783-793; 1974.* (15 references) (Japanese)

Survival abilities of salmon fry at different stages of growth in stagnant and bubble-aerated water containing various pesticides at several concentrations were examined. The lethal concentration ranges of 50% sodium perchlorate, 5% pentachloronitrobenzene (PCNB), 75% Zn-Mn ethylenebisdithiocarbamate, (mancozeb) 70% hydroxymethylisoxazole, 25% thiometon, and 34% phosvel (leptophos) were determined as 3000-5500, 75-300, 0.3-1.0, 110-120, 4.8-9.5, and 0.007-0.056 ppm in stagnant water, and 6000-7000, 200-250, 4.0-7.0, greater than 200, greater than 23.7, and 0.056-0.112 ppm respectively in aerated water. In water which was aerated for 48 hr and was then kept stagnant, the lethal concentration range was between the above two ranges.

74-2659. Froede, H. C.; Wilson, I. B. (Sch. Pharm. and Dept. Chem., Univ. Colorado, Boulder, CO 80302). **Equilibrium constants and relationships in the inhibition of serinesterases by organophosphates.** *Mol. Pharmacol. 10(4): 696-702; 1974.* (21 references)

The equilibrium constants for the reactions of diethyl phosphofluoridate and eel acetylcholinesterase, bovine red cell acetylcholinesterase, horse serum butyrylcholinesterase, and bovine α-chymotrypsin were measured. The values obtained were 2.3×10^4, 3×10^5, 6.4×10^6, and 6×10^8, respectively, in terms of analytical concentrations at pH 7.0 and 25°, with water activity as unity. These were converted to equilibrium constants for the hydrolysis of the diethylphosphoryl-enzyme derivative: 5.2×10^{10}, 4×10^9, 2×10^8, and 2×10^6, respectively. These values enable one to calculate the equilibrium constant for the reaction of these enzymes with any diethyl phosphate ester whose equilibrium constant for hydrolysis is known. If the constant for inhibition is also known, the rate constant for reactivation of the inhibited enzyme can be calculated. These calculations were made for diethyl *p*-nitrophenyl phosphate and the conjugate reactivator *p*-nitrophenol and checked experimentally for the eel enzyme. (Author abstract by permission of Academic Press)

74-2660. Michael, A. G.; Grant, G. S. (Navy Environmental Preventive Med. Unit. No. 2, Norfolk, VA 23511). **Toxicity of the repellent DEET(*N,N*-diethylmetatoluamide) to *Gambusia affinis* (Baird and Girard).** *Mosquito News 34(1): 32-35; 1974.* (7 references)

The effects of 0, 125, 200, 315, and 500 ppm of DEET were studied on mosquitofish (*Gambusia affinis*). The LC50 values were approximately 235 ppm for both 24 and 48 hour exposure. All fish appeared to become tranquilized 1 to 3 minutes after the introduction of DEET. The fish did not respond to hand movements near the containers and, as the experiment progressed, exhibited a pronounced equilibrium imbalance at all concentrations. Surviving fish transferred to fresh water showed complete and rapid return to equilibrium with no visible side effects. The toxicity of DDT to *Gambusia affinis* appears to be very low in comparison to the organochlorine and organophosphate insecticides.

74-2661. Barnes, J. M.; Verschoyle, R. D. (M.R.C. Toxicol. Unit, Med. Res. Council Labs., Carshalton, Surrey, England). **Toxicology of new pyrethroid insecticide.** *Nature (London) 248(5450): 711; 1974.* (2 references)

The lethal dose of the pyrethroid insecticide NRDC 156 in female albino rats was 6-8 mg/kg i.v. in glycerol formal solution. The lethal dose of NRDC 161 was 2-2.5 mg/kg. Given orally in arachis oil solution, NRDC 156 caused severe toxic effects and some deaths in a dose range of 80-160 mg/kg, while NRDC 161 had similar effects in a dose range of 25-63 mg/kg. The first sign of poisoning was excessive salivation without lachrymation. This was rapidly followed by continuous irregular jerking movements of the limbs, rolling convulsions, and occasional toxic-clonic convulsions. Death occurred 12 minutes to 2 hours after i.v. dosing and 3.5 to 28 hours after oral dosing. The survivors returned to normal 4 to 6 hours after i.v. dosing and up to 48 hours after oral dosing. Both pyrethroids appeared to act centrally with little or no peripheral action.

74-2662. Prince, R. H.; Stotter, D. A. (Univ. Chem. Lab., Lensfield Rd., Cambridge, Great Britain). **Alkyl-cobalt mediation of DDT hydrolysis.** *Nature (London) 249(5454): 686-687; 1974.* (12 references)

The Co(II) complex of the macrocyclic ligand CR was prepared and reduced to the nucleophilic Co(I) species. This was allowed to react under nitrogen with pure *p,p'*-DDT, and the solution was warmed to 40°C and stirred for 12 hours in the dark. A deep red, light-sensitive solution resulted; the addition of PF_6^- or ClO_4^- to it produced a red, tarry product. Repeated reprecipitation from ethanol/ether produced a small quantity of the ClO^{-4} salt. Silver nitrate titration produced an ionic chloride solution, extraction of which with toluene yielded a white powder identified as di(*p*-chlorophenyl)-ketone. Microanalysis of the alkyl-cobalt intermediate

indicated that it consisted of: C 44.8%, H 4.5%, N 7.7%, and total Cl 18.1%. Thus, the involvement of alkylcobalt species in the hydrolytic detoxification of DDT is chemically feasible, and the hydrolysis and partial degradation of DDT by this route requires far less vigorous conditions than the strong base and oxidizing agents usually used to bring about these reactions.

74-2663. Mueller, P.; Korte, F. (Inst. fuer Oekol. Chem., Gesellschaft fuer Strahlen- und Umweltforsch. mbH, Munich, Germany). **Mikrobielle Umwandlung von Xenobiotica bei der Muellkompostierung. [Microbial transformation of xenobiotics during refuse composting.]** *Naturwissenschaften 61(7): 326; 1974.* (9 references) (German)

Household refuse contains polychlorinated biphenyls (PCB)—concentrations of 0.4-9.7 ppm were measured in 23 samples—as well as pesticides like DDE, lindane, hexachlorobenzene, aldrin, and dieldrin. The conversion of these substances to less harmful compounds by saprophytic microorganisms during the refuse composting process was studied using ^{14}C as a tracer in a laboratory apparatus designed to simulate composting conditions. Homogenized refuse was mixed with 1-20 μg/g of 2,2-dichlorobiphenyl aldrin, heptachlor, buturon, imugan (chloraniformethane), and *p*-chloroaniline. Following composting the trash-compost was extracted with organic solvents. Recoveries exceeded 95% for the pesticides tested. Not more than 50% of any of the xenobiotics tested was converted by the microorganisms. The fraction of unchanged 2,2-dichlorobiphenyl in the extract, in fact, was 98%. The other xenobiotics were 5-45% converted, primarily via enzymatic processes of the saprophytic organisms. Most of the conversion products were still highly persistent; for example, 86% of the buturon degradation product *p*-chloroaniline survived the composting process unchanged.

74-2664. Sarkander, H. I.; Kemmerle, M.; Brade, W. (Pharmakol. Inst. der Freien Univ. Berlin, D-1000 Berlin 33, Germany). **Rat liver histone modifications and their relationship to DNA-dependent RNA polymerase activities during α-hexachlorocyclohexane induced liver proliferation.** *Naunyn-Schmiedeberg's Arch. Pharmacol. 284(1): 39-53; 1974.* (75 references)

The time course of histone acetylation, methylation and phosphorylation during α-hexachlorocyclohexane (α-HCH, α-BHC) induced liver cell proliferation has been studied and correlated to other biochemical events in rat liver caused by α-HCH. Both in vitro acetylation and methylation showed an initial increase 1 and 2 hr after α-HCH which obviously precedes the beginning of increased nuclear in vitro RNA synthesis. Separation of in vitro acetylated liver histones isolated 1 and 2 hr after α-HCH application results in a preferential accumulaton of radioactive acetate in the range of F 3, F2B, F2a2 histone fractions and in F 2a1. A second peak of increased histone acetylation at 24 hr and methylation at 36 hr occurs during a period of increased nuclear RNA polymerase activities and the beginning increase of DNA synthesis. An increased in vitro histone phosphorylation was measured 42 hr after α-HCH application. From the different time courses of these nuclear events it seems possible that the early histone acetylation and methylation might be involved in the beginning increase of transcriptional activity. Further experiments will be necessary to find out whether the α-HCH induced histone modifications occurring 1, 2 hr and 24, 36, 42 hr are biologically significant in the sense of a causal connection for α-HCH caused increase of transcriptional activity, DNA replication or enzyme induction or whether they are independent of each other and merely coincide. (Author abstract by permission)

74-2665. Mawdesley-Thomas, L. E. (Huntingdon Res. Cent., Huntingdon, England). **Toxic chemicals—the risk to fish.** *New Sci. 49(734): 74-75; 1971.*

This article describes serious deficiencies in the way chemicals likely to be released into the environment are tested for toxicity against fish. In the continuous flow test, fish are tested in batches of 10 in 500 ml spherical flasks through which 100 ml of freshly prepared test solution is passed every 10 minutes. Although this technique is considered to be better than the static tank test, it does little more than produce columns of LD50 values. These figures are usually totally inadequate as a guide to the potential hazards to any particular ecosystem. The U.S. authorities have suggested that residue analyses be carried out at 3, 7, and 14 days, and every 14 days thereafter until a persistence time for the pesticide is established. A depressing feature of British government requirements is the short term duration (usually one day) on which some toxicity tables are based. The author recommends long term chronic toxicity tests, including effects of sub-lethal doses. Instead of using the small harlequin, the fish used for acute toxicity studies in the U.K., a larger fish, particularly the trout, should be used because of its suscepti bility to various toxic chemicals.

74-2666. Tokori, T.; Suzuki, K.; Otsuka, J. (Sch. Ophthalmol., Fac. of Med., Tokyo Med. and Dental Univ., Tokyo, Japan). **[Effect of prifinium bromide on experimental chronic intoxication by an organophosphorus pesticide in beagles.]** *Nippon Ganka Gakkai Zasshi (J. Jap. Ophthalmol. Soc.) 78(6): 285-290; 1974.* (10 references) (Japanese)

Beagles were given ethylthiometon capsules at 5 (two dogs), 10 (two dogs), or 15 (one dog) mg/kg/day respectively plus 90 mg of prifinium (pyrodifenium) bromide (all five dogs) for two years (E+P). The ocular refraction, astigmatism, and ocular refractive components were examined in March and Dec. 1971 and

Oct. 1972, and the intraocular pressure was measured in Dec. 1971 and Oct. 1972. The data obtained were compared to those for five beagles given ethylthiometon alone (E) and for six untreated beagles (C). The higher the ethylthiometon dose level, the more severe the myopia which developed. The degree of development in the E+P group was lower than that in the E group and higher than that in the C group. The degree of corneal astigmatism and total astigmatism in the E+P group were smaller than in the E group. In the E group, the shift towards hypermetropia after instillation of tropicamide was greater in Dec. 1971, but was smaller in Oct. 1972; on the other hand, the shift in the E+P group tended to be the same as in the C group. The reductior of RBC ChE activity was the same as that in the E group, and a significant difference was observed between the E+P and C groups. No great changes in the refractive components or the intraocular pressure were observed. From these findings it was concluded that administration of prifinium bromide seemed to prevent the development of myopia due to organophosphorus pesticides.

74-2667. Michail, G. (Iasi Inst. Public Health and Med., Iasi, Rumania). **[Experimental studies on toxic effects of BHC and parathion administered jointly.]** *Nippon Noson Igakkai Zasshi (J. Jap. Ass. Rural Med.) 22(6): 772-773; 1974.* (Japanese)

Three groups of 12 rabbits each were treated with BHC for one month, then with parathion for one month, then the treatment cycle repeated. The intervals between treatments were four months, to allow for the appearance of symptoms by enzyme induction afer BHC treatment and for the activation of aliesterase. The toxic action was measured via specific and non-specific metabolic effects as well as biochemical and enzyme indicators. The results revealed no synergism between the two insecticides. The changes in serum and erythrocyte cholinesterase activities were less than when only parathion was administered; the rate of *p*-nitrophenol excretion was accelerated compared to that when only parathion was administered. (Proc. 1st Congress of Asian Rural Med., Oct. 24-27, 1973, Nagano, Japan).

74-2668. Draeger, G. (Pflanzenschutz Anwendungstech., Biol. Forsch., Farbenfabriken Bayer AG, Leverkusen, Germany). **Studies on the metabolism of phoxim (Bay 77488).** *Pflanzenschutz-Nachr. 24(2): 239-251; 1971.* (5 references)

Surfaces of greenhouse grown cotton leaves were brushed with an aqueous emulsion of unlabeled and ^{32}P-labeled phoxim. Leaves were extracted and analyzed for phoxim and metabolites. One hour after application, a photoisomerization product, diethoxyphosphorylthioiminophenylacetonitrile (I), accounted for 6% of total radioactivity, reaching a maximum of 15% after 24 hours and dropping to 1% after 3 days. One day after application, the unchanged parent compound accounted for 20% of total activity, dropping to less than 1% after five days. In parallel experiments in complete darkness, the parent compound was degraded much more slowly and I was present only in very small amounts. Other degradation products were *O,O,O,O*-tetraethyldiphosphate (TEPP) and *O,O,O,O*-tetraethylmonothiodiphosphate (II). Gas chromatographic studies of phoxim degradation on glass plates showed qualitatively similar results. However, the percentage of TEPP and II was considerably less than in exposure of the parent compound to light on cotton leaves. Structures of metabolites were determined by mass spectral analysis and NMR and confirmed by gas and thin-layer chromatography.

74-2669. Wenger, B. S.; Wenger, E. (Dept. Anat., Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada). **Prevention of malathion-induced malformations in chick embryos by nicotinamide and tryptophan.** *Proc. Can. Fed. Biol. Soc. 16: 61; 1973.*

Application of 3 μl of malathion directly to the area vasculosa of NH chick embryos on each of two successive days (4 and 5) of incubation produced the characteristic parrot beak-micromelia syndrome (PBM) in 100% of survivors; mortality was no greater than in controls. Application of 0.1 ml nicotinamide (0.2 *M*) or tryptophan (0.1 *M*) simultaneously with malathion prevented the development of PBM in all survivors, but mortality was increased after application of nicotinamide. Tryptophan was effective at the same dosage, whether applied to the surface of the blastoderm or injected into the yolk. Malathion apparently interferes with mobilization of tryptophan from yolk proteins, consequently decreasing nicotinamide synthesis. This in turn leads to deficiencies of pyridine nucleotide-dependent reactions, which are involved in early differentiation phases in limbs, beak, feathers, and other organs.

74-2670. Virgo, B. B.; Bellward, G. D. (Div. Pharmacol. Toxicol., Fac. Pharm. Sci., Univ. of British Columbia, Vancouver, B. C., Canada). **Effect of dietary dieldrin on the liver and drug metabolism in the SWV mouse.** *Proc. Can. Fed. Biol. Soc. 16: 69; 1973.*

Liver mass, microsomal protein, cytochrome P450, and in vitro microsomal metabolism of imipramine (I) were determined at intervals in 13-week-old female mice exposed to 5, 10, 15, or 20 ppm dieldrin for 10 weeks. No correlation of age was found with changes in liver size, microsomal protein, or P450. *N*-oxidation and hydroxylation of I increased with age while demethylation decreased. Dieldrin dose-related changes included increases of up to 60% in liver mass, 230% in P450, and 30-35% in microsomal protein. Plateau levels were reached for microsomal protein at day 5 and for liver size at day 14 of exposure. P450 declined after reaching peak levels at 3-4 weeks. Pentobarbital sleeping time was

decreased 430% in animals exposed to 5 ppm for 4 weeks; higher doses did not further reduce it. Dieldrin induction did not increase the rate of microsomal I metabolism but quantatively altered the metabolites formed. After 2 and 4 weeks of exposure to 20 ppm dieldrin hydroxylation and demethylation were increased and *N*-oxidation was decreased. Five and 10 ppm appeared to cause similar changes after 8 weeks.

74-2671. Virgo, B. B.; Bellward, G. D. (Div. Pharmacol. Toxicol., Fac. Pharm. Sci., Univ. B. C., Vancouver, B. C, Canada). **Effect of dieldrin on mouse reproduction.** *Proc. Can. Fed. Biol. Soc. 16:103; 1973.*

Numbers bred and gestation time were unaffected in 130 primiparous SWV female mice fed dieldrin-contaminated rations and mated during weeks 4-6 of exposure. Adult mortality occurred only at 20 and 25 ppm. Survivors fed 20 and 25 ppm were fertile, but litter size was reduced by 15%. Infertility resulted in 18% of the females fed 10 and 15%. In a separate study dieldrin at 15 ppm decreased the number of females with decidua 5 days *post coitum* while 25 ppm significantly reduced the number of decidua per female. The rate of litter loss was dose-related and correlated with the dams dieldrin-induced hepatomegaly. Between dams, variances in pup death rate were heterogeneous even within doses. At doses greater than 10 ppm dams weaned no litters; litter loss was elevated to 47% at 2.5 ppm, and (significantly) increased to 80% at 5 ppm. Survival rate and growth of pups in litters raised by dams fed 2.5 and 5 ppm were normal but the birth weight of pups born to unsuccessful dams was reduced 6 to 13%, and pre-death growth of pups was reduced or absent. Maternal neglect and infanticide were important proximate mortality causes but only at doses greater than 15 ppm.

74-2672. Ecobichon, D. J. (Dept. Pharmacol., Dalhousie Univ., Halifax, N. S., Canada). **Species differences in reactivation of organophosphate-inhibited plasma esterases by oximes.** *Proc. Can. Fed. Biol. Soc. 16: 103; 1973.*

Enzyme activity of diisopropylfluorophosphate (DFP)-inhibited plasma esterases from the rat, guinea pig, rabbit, horse, cat, and human was studied in vitro following administration of diacetylmonooxime (DAM). The rat, rabbit, and guinea pig have high plasma aliesterase (AliE) levels. The in vitro inhibition of AliE by DFP could be effectively reversed by 2-10m*M* DAM only in the rat; the AliE activity had returned to normal two hours after the addition of 110m*M* DAM. Slight reactivation of cholinesterase (ChE) was observed. Slight reactivation of AliE was observed in the guinea pig but not in the other species. The reaction is peculiar to the rat in which the AliE differs from the plasma AliE of other mammalian species.

74-2673. Clement, J.; Hirst, M.; Colhoun, E. H. (Univ. Western Ontario., London, Ontario, Canada). **Toxicity of acetylcholine mustard.** *Proc. Can. Fed. Biol. Soc. 16:103; 1973.*

Toxicity of acetylcholine mustard (AChM) in the housefly and American cockroach, as shown by the LD50, is quantitatively similar to topically applied nicotine (base). The solvent for AChM and its route of application are important factors in toxicity. Results show that AChM is toxic to mammals as well as insects. These results, together with studies on precursors and degradative products of AChM, suggest that the aziridine and aziridinium ion are responsible for toxicity. Discussion will be made of the mechanism of toxicity of AChM in insects, with particular emphasis on lipid solubility of the parent molecule, formation of ion species, penetration into tissues, and inhibition of acetylcholinesterase.

74-2674. Hrdina, P. D.; Peters, D. A. V.; Singhal, R. L. (Dept. Pharmacol., Univ. Ottawa, Ottawa, Ont, K1N 6N4, Canada). **Acute neurotoxic effects of α-chlordane and alterations in brain biogenic amines.** *Proc. Can. Fed. Biol. Soc. 16: 103; 1973.*

Effects of an acute oral dose of α-chlordane (200 mg/kg) in rats included moderate tremors, paralysis of hind legs, and episodes of severe tonic-clonic convulsions. In sharp contrast to the marked hyperthermia seen with *p,p'*-DDT, body temperature decreased by 1.5, 3.2, and 3.8°C, respectively, at the 2nd, 3rd, and 4th hr after α-chlordane administration. Brain stem norepinephrine remained unaltered at the 2nd hr but decreased by 24% at 3rd hr. Levels of brain stem 5-HIAA 5-hydroxyindolylacetic acid were increased at the 2nd and 3rd hr to 132 and 40% of the control values, respectively, but no changes were noted in 5-HT. Pretreatment with 6-fluorotryptophan (100 mg/kg) abolished the increase in 5-HIAA but failed to influence the hypothermia and the decrease in brain stem NE seen with the pesticide. Administration of α-chlordane also lowered ACh levels by about 25% in both the cortex and the striatum, while AChE activity increased by 21% in the cortex and by 16% in the striatum. The association of changes in brain ACh with the convulsive activity is suggested, whereas alterations in 5-HT metabolism may be secondary to the hypothermia observed with α-chlordane.

74-2675. Singhal, R. L.; Kacew, S. (Dept. of Pharmacol., Univ. of Ottawa, Ottawa, Canada K1N 6N5). **Cyclic AMP and insecticide action on the rat kidney cortex.** *Proc. Can. Fed. Biol. Soc. 16: 104; 1973.*

Enhancement of key glyconeogenic enzyme activities, elevation of blood glucose and urea levels, depletion of liver glycogen, and increased ability of liver and kidney cortex to tranform adenosine-H^3 into cyclic AMP-H^3 were observed in animals treated with chlori-

nated hydrocarbon insecticides. The synthesis of cyclic nucleotide from tritiated adenosine was measured in kidney cortex slices from insecticide-treated animals to further demonstrate that pesticide-induced changes in carbohydrate metabolism may be mediated through cyclic AMP. Significant increases in cyclic AMP-H^3 formation were seen one hour after oral administration of *p,p'*-DDT (600 mg/kg), α-chlordane (200 mg/kg), heptachlor (200 mg/kg), and endrin (50 mg/kg). Imidazole blocked the *p,p'*-DDT-induced rise in kidney cyclic AMP-H^3 formation whereas caffeine potentiated the insecticide's action on cyclic nucleotide synthesis. Pretreatment with hydrazine or propranolol effectively prevented the DDT-stimulated increase in the synthesis of renal cyclic AMP-H^3. Administration of *p,p'*-DDT also enhanced endogenous cyclic AMP levels and the activities of basal and fluoride-stimulated forms of adenyl cyclase.

74-2676. Pang, A. S. D.; Aston, W. P. (Dept. Microbiol. Immunol., Queen's Univ., Kingston, Ont., Canada). **The inactivation of bovine C1 by diisopropylfluorophosphate and other esterase inhibitors.** *Proc. Can. Fed. Biol. Soc. 16: 111; 1973.*

Earlier studies revealed that guinea pig C3-C9 lyses a stable lytic intermediate of bovine origin (*bov*), EAC *bov*142. The presence of C1 in this intermediate is essential for lysis. Partially purified bovine C1 was obtained from fresh serum by precipitation at low ionic strength ($\mu = 0.04$) and pH 7.5, followed by chromatography on Sephadex G-200. DFP and other compounds which inhibited C1 esterase activity also inhibited the ability of C1 to reform an active EAC*bov*142 intermediate from EAC*bov*42. Preliminary exposure of the cells to DFP-inactivated C1 did not inhibit the uptake of active C1 by EAC*bov*42. The lytic activity of EAC*bov*142 was not inhibited by treatment of the complex with DFP. Thus the C1 appears to have an intimate relationship with one or both of the C4 and C2 components, essential for the lytic activity of the EAC*Bov*142 complex.

74-2677. Glick, B. (Poultry Sci. Dept., Mississippi Agr. and Forestry Exp. Sta., Mississippi State Univ., Mississippi State, MS 39762). **Antibody-mediated immunity in the presence of mirex and DDT.** *Poultry Sci. 53(4): 1476-1485; 1974.* (33 references)

The objective of these experiments was to evaluate the influence of Mirex and DDT on antibody-mediated immunity in the chicken. Feeding 200-400 ppm of Mirex for up to 5 weeks of age did not significantly influence body weight, weights of the bursa, spleen, adrenal, thymus, or liver, level of immunoglobulin M (IgM) or IgG, antibody response as measured by precipitin levels to bovine serum albumin (BSA) and number of plaque forming cells to sheep red blood cells or absolute number of lymphocytes and heterophils. Only body weight was significantly reduced by feeding 800 p.p.m. Mirex. Feeding 500 ppm of Mirex significantly depressed the levels of IgG and IgM, but did not influence antibody production. DDT was lethal only at 100 ppm when 3/4 of all chicks died during the first 2 weeks after hatching. Feed withdrawal for 3–4 days before injecting BSA significantly depressed precipitin production and IgG levels in birds receiving 400 ppm but not 200 ppm of DDT. Feed withdrawal at the time of BSA injection and for the next 7 days did not influence birds receiving 200 ppm DDT but significantly reduced titers in birds fed 400 ppm DDT. The antibody responses of Mirex birds (200 or 400 ppm) was not modified. These data indicate that chickens exposed to high levels of DDT and faced with starvation and other possible environmental changes are less able to mount a normal antibody response. (Author abstract by permission)

74-2678. Cumberland, G. L. B.; Honore, E. N.; Clout, G. (Res. Div., Min. Agr. Fish., Auckland, New Zealand). **Responses in young sheep to fungicides applied to grazed pasture.** *Proc. N. Z. Weed Pest. Contr. Conf. 26: 126-128; 1973.* (2 references)

In four trials benomyl (0.56 kg/ha) was applied to pastures grazed by hoggets to inhibit growth of *Myrothecium*. Thiabendazole (0.3 kg/ha) was applied to all plots in an attempt to prevent facial eczema. The effect of these chemicals on the hoggets grazing in the pastures was studied. Only in two of the trials did live weight changes achieve significance. Some animals in one group contracted facial eczema. In two of the trials there was a significant reduction of scouring, a sign of ill health of the animals, and a reduction in "runny noses" just failed to achieve significance. In the other two trials there was no case of scouring or "runny nose" symptoms. Because of complexities of laboratory procedures, it has not been possible to demonstrate that benomyl treatment has definitely reduced the incidence of toxic *Myrothecium* strains.

74-2679. Joy, R. M. (Dept. Physiological Sci., Sch. Vet. Med., Univ. California, Davis, CA 95616). **Temporal sequencing of dieldrin induced epileptiform spikes in the cat.** *Proc. West. Pharmacol. Soc. 17: 82-96; 1974.* (2 references)

Anesthetized cats were treated with dieldrin via the injection of small graded doses through femoral vein cannulae. Spike discharge in response to the dieldrin first developed in the mesencephalic reticular formation (RF). Responses were later observed in the anterior and posterior sigmoid gyri (ASG and PSG), then in the dorsomedial nucleus (DM), the caudate nucleus (CD), and the ventral posterolateral nucleus (VPL), respectively. The spikes were biphasic, positive-negative potentials in monopolar records. Responses in the ASG and PSG were essentially simultaneous, and both pre-

ceded responses in the nuclei which project to them (DM and VPL). In addition, activity originated in the caudate later than in the cortex. The data indicates the existence of a focus initiating the spike discharge, but also indicates that the focus is not cortical, and that the conduction pathway does not involve the classical lemniscal system. The focus probably lies posterior to the RF.

74-2680. Griffin, C. S. (Pyrethrum Bur., Nakuru, Kenya). **Mammalian toxicology of pyrethrum.** *Pyrethrum Post 12(2): 50-58; 1973.* (58 references)

This article is a review of pyrethrin toxicity to mammals by different routes of adminstration. The acute oral dose of pyrethrins for man has been estimated at 1000-20000 mg/kg. Chronic adminstration of 911 mg/kg/day over 5 weeks to rats resulted only in prominent Peyer's patches in the ileum of two animals. A small cecal enlargement was found in most rats ingesting 35 mg/kg/day pyrethrins and 175 mg/kg/day piperonyl butoxide. Samples of 1 ml of 1% pyrethrins/kg/day were applied to rabbit skin for 15 days, 6-8 hours/day. No compound related effects were found. No ill effects or hematologic disturbances were noted after exposing rats for 30 minutes each day for 85 days to a spray of 1.3 g of 1.0% pyrethrins in a 0.57 m^3 chamber. No rats died after a single 30 minute exposure to 370 g of 1.0% pyrethrins in the same space. Toxicity after administration by parenteral routes was increased by solvents. The i.v. toxicity, by far the highest, was about 5-10 mg/kg. Pyrethrins diluted in hydrocarbons were slightly irritating to eyes of rabbits, but eyes were normal after 24 hrours. The two allergens in the pyrethrum flower are removed early in the modern extraction process. Studies on teratogenicity with mice and rats showed birth patterns similar to controls. Both pyrethrins and piperonyl butoxide are non-mutagenic for *E. coli*. The toxicity of synergists, diluents, and propellants is discussed.

74-2681. Saxena, P.; Saxena, S. C. (Dept. Zool., Univ. Rajasthan, Jaipur, India). **Effect of pyrethrum on body and org n weights, food consumption and faeces production of the house sparrow, *Passer domesticus* (L).** *Pyrethrum Post 12(2): 76; 1973.* (1 reference)

Twenty-six, 39, and 52 mg pyrethrins/kg body weight were administered orally to caged sparrows after mixing the required quantity of pyrethrum with grain. Sparrows were starved for 2-4 hours before the eight day experiment began. At the highest dosage food consumption, feces production, body weight, and organ weight (liver, intestines, pancreas, kidneys, testes) were lower than in controls, and there was a greater flying tendency and hyperexcitability with loud chirping. No change was observed in birds at 26 and 39 mg/kg. At the highest dosage pyrethrins may have affected the hypothalamus, since it is known that lesions of the lateral hypothalamus and ventromedial nuclei cause loss of appetite.

74-2682. Moll, H. M.; Vila, M. C.; Heras, C. (Dept. de Biol., Fac. de Ciencias, Univ. de Zaragoza, Zaragoza, Spain). **Efectos del fungicida benlate 50% en el nucleo celular. [Effects of 50% benlate fungicide on the cell nucleus.]** *Rev. Acad. Cienc. 28(3): 373-375; 1973.* (3 references) (Spanish)

The effects of the fungicide benlate 50% were studied on cell nuclei and chromosomes of *Allium cepa* roots. As soon as the length of the roots attained 1 cm, the specimens were transferred into nutrient solutions containing 96 ppm, 48 ppm, 24 ppm, 12 ppm, and 6 ppm benlate. The specimens were exposed to these solutions for periods ranging from 3 hr to 5 days. Chromosomal aberrations manifested themselves in 15 hr in the solutions with 96 ppm and 48 ppm benlate while the aberrations observed in 24 ppm and 12 ppm solutions were less pronounced (growth inhibition during the first 24 hr). In the 96 ppm and 48 ppm solutions, the cells were affected by benlate in the prometaphasic and metaphasic stages, developing elongated chromosomes, while the chromosomes exposed to 12 ppm benlate tended towards fragmentation.

74-2683. Bankowska, J.; Bojanowska, A. (Inst. San. Toxicol., Nat. Inst. Hyg., Warsaw, Poland). **Wyplyw linuronu i chlortoluronu w krotkookresowym doswiadcaeniu chroniczymy na mlodych szczurach na szybkosc metabolizowania heksobarbitalu aktywnosci niektorych enzymow watroby. [Short-term chronic experiments on young rats concerning the effects of linuron and chlortoluron on the rate of hexobarbital metabolism and activity of some liver enzymes.]** *Rocz. Panstw. Zakl. Hig. 25(2): 137-144; 1974.* (12 references) (Polish)

A 13-week controlled experiment was performed on 5 groups of young male Wistar rats, 25 in each group. The animals received diet with the following concentrations of the herbicides: linuron 500 ppm, linuron 5000 ppm, chlortoluron 500 ppm, chlortoluron 5000 ppm. After the first, third, sixth, and thirteenth weeks of intoxication 5 rats were killed in each group and the rate of hexobarbital metabolism as well as the glucose-6-phosphatase and alkaline phosphatase activities were determined in the postmitochondrial supernatant of isolated liver extracts. A considerable instability of the hexobarbital-metabolizing system was observed both in the investigated groups and in the control group. However, a tendency for increased metabolic activity was observed in rats receiving diet with 5000 ppm of chlortoluron in the time period from the 6th to the 12th week. The activity of glucose-6-phosphatase and alkaline phosphatase was within the range of the widely scattered normal values throughout the experiment.

74-2684. Urbanowicz, M.; Gawecki, J.; Bonk, B.; Maciejewska, A. (Academy of Agriculture, Poznan, Poland). **Wplyw wybranych pestycydow z grupy karbaminianow na strawnosc diety. [The effect of selected pesticides from the carbamate group on digestibility of diet.]** *Rocz. Panstw. Zakl. Hig. 25(2): 145-151; 1974.* (18 references) (Polish)

Preliminary animal studies were performed on adult male Wistar rats to determine the effects of some pesticides from the carbamate group on the digestibility of diet. Commercial preparations of the carbamate pesticides Carbatox (carbaryl), Cyncotox (zineb), and Dithane M-45 (mancozeb) were added to LSM animal chow in amounts corresponding to 1/10 LD50. Using the balance method the indices of apparent digestibility of the diet components were determined. The addition of each of these pesticides caused a definite decrease in food intake, which was greatest in the case of Dithane M-45, followed by Cyncotox. In the case of Dithane M-45 a similar decrease of food intake was also observed when the added amount was 1/50 of the LD50. No diarrhea was observed in the animals and the water content in the collected feces was balanced; in the case of Dithane M-45 the water intake was appreciably decreased. The results obtained indicate that the pesticides disturbed the digestive process. These disturbances were primarily apparent in the digestibility of fat and total protein. Digestibility of fibers and dry matter was little affected. The greatest effect of the pesticides investigated was on the digestibility of fat ($p < 0.001$), and the digestibility of total protein was also considerably influenced ($p < 0.05$). Cyncotox decreased the digestibility of fat, on the average, by 14.79%, Carbatox suspension by 7.08%, and Dithane M-45 (dose 1/50 of LD50) by 6.62%. No correlation was observed between the presence of the tested pesticides in the diet and the digestibility of the carbohydrate components.

74-2685. Asanuma, S.; Nakamura, T.; Suzuki, A.; Hirooka, Y.; Kurosawa, K.; Matsushima, S. (Nippon Inst. of Rural Med., Usuda, Nagano, Japan). **[An experimental study on the organophosphorus pesticide residues in humans.]** *Sangyo Igaku (Ind. Med.) 16(1): 36-37; 1974.* (Japanese)

Rats and monkeys were administered fenitrothion to learn more on organophosphorus pesticide residues in humans. Male Wistar rats about 300 g were administered fenitrothion dissolved in olive oil p.o. at 300 mg/kg. The residual amount and cholinesterase activity were determined 1, 3, and 9 hr and 1, 2, 5, 10, and 15 days after adminstration. Electron microscopic observations of ocular muscles and determinations of *p*-nitro-*m*-cresol excreted in the urine were made. The intraorgan residue of fenitrothion was the highest on the first day and disappeared on the tenth day; the cholinesterase was slow to recover; fenitrothion affected external ocular muscle and nerve motor end plates.

74-2686. Van Logten, M. J.; Wolthuis, M.; Rauws, A. G.;* Kroes, R.; Den Tonkelaar, E. M.; Verkvens, H.; Van Esch, G. J. (Lab. Toxicol. Pharmacol. Pathol., Nat. Inst. Pub. Health, P.O. Box 1, Bilthoven, The Netherlands). **Semichronic toxicity study of sodium bromide in rats.** *Toxicology 2(3): 257-267; 1974.* (9 references)

Wistar-SPF rats were divided into groups of 10 males and 10 females and fed diets of 0, 75, 300, 1200, 4800, 19200 ppm sodium bromide. Grooming was depressed in rats in the highest dosage group and motor incoordination of the hind legs was apparent. The males in this group exhibited significant growth retardation throughout the 13 week study and the females during the first 6 weeks. Urine was normal except for isolated traces of hemoglobin. PCV and erythrocyte counts were somewhat lower in the 19200 ppm group, and the percentage of neutrophil granulocytes was doubled from 6-12 without distinct changes in total leukocyte counts. A tendency toward raised alkaline phosphatase occurred in this group. Bromide concentrations in brain, kidneys, and plasma were proportional to dosage except for the highest group, and brain to plasma bromide and kidney to plasma bromide ratios were 0.2 and 0.6 respectively. Relative thyroid weight was increased in females in the 1200, 4800, and 19200 groups and in males in the 19200 group. Relative prostate weight decreased in the 4800 and 19200 groups. In males and occasionally in females of the 19200 group, pituitary cysts occurred. In adrenals of all animals, there was strikingly less vacuolization in the zona fasciculata.

74-2687. Jones, D. C.; Davis, W. E.; Newell, G. W.; Sasmore, D. P.; Rosen, V. J. (Life Sci. Div., Stanford Res. Inst., Menlo Park, CA 94025). **Modification of hexachlorophene toxicity by dieldrin and Arochlor 1254.** *Toxicology 2(3): 309-318; 1974.* (8 references)

Five-week-old Fischer-344 rats were fed diets containing hexachlorophene (HCP) alone or paired with either aflatoxin B_1, Arochlor 1254, or dieldrin for 8 weeks. HCP alone at 400 ppm or less caused no mortalities; 80% of the males and 73% of the females died within 5 weeks at 820 ppm. There were no mortalities among animals fed aflatoxin (1 ppm), Arochlor 1254 (200 ppm), or dieldrin (100 ppm) alone, at dosages similar to those given in the combined studies. Diets combining HCP (600 ppm) with aflatoxin (1 ppm) resulted in at least as great mortality as with HCP alone. Arochlor 1254 (160 ppm) reduced HCP (600 ppm) 8 week mortality from over 70% to less than 7%. Dieldrin (100 ppm) reduced HCP (900 ppm) mortality from 100% to less than 4%. Minimal neuronal degeneration was present in the brain at 50 ppm HCP, focal necrosis and myelin vacuolization at 400 ppm or higher, and focal hemorrhage at 600 ppm.

74-2688. Brusilovskiy, Ye. S.; Fial'kovskiy, A. M. (Dept. Allergol., All-Union Inst. Hyg. Toxicol. Pesti-

cides, Polymers and Plastic Materials, Kiev, USSR). **Eksperimental'noye izucheniye kozhno-allergicheskogo deystviya tetrametiltiuramdisul'fida. [Experimental study of the skin allergic action of tetramethylthiuram disulfide.]** *Vestn. Dermatol. Venerol. 47: 28-31; 1973.* (16 references) (Russian)

The al'ergic effect of TMTD (thiram) on skin was studied in albino rabbits. Two groups of animals were sensitized by intracutaneous administration of 0.1 ml 0.5% TMTD with or without 0.1 ml Freund's adjuvant, while a third group was sensitized by epicutaneous application of 0.1 ml 2% TMTD for 15 consecutive days. The inducing dose of 0.1-2% TMTD was adminstered intracutaneously to the first and second groups, and a 0.1-10% concentration was given percutaneously to the third group. Contact dermatitis of the allergic type due to TMTD was observed. Humoral antihapten antibody was found to participate in the development of the contact dermatitis, and the antibody level was dependent on the intensity of the allergic process. The negative results of the basophil degranulation, mast cell degranulation, and passive skin anaphylaxis tests in the second and third groups may be due to non-involvement of these reactions in the development of contact allergy.

74-2689. Zhulenko, V. N.; Georgiyeva, G. N.; Smirnova, L. A. (Moscow Inst. Technol. of the Meat and Dairy Industry, Moscow, USSR). **Nakopleniye rtuti v organakh i tkanyakh. [Accumulation of mercury in organs and tissues.]** *Veterinariya 4: 107-108; 1974.* (Russian)

The accumulation and distribution of mercury in different organs and tissues of calves fed 1/200 LD50 of granosan for 45 days were investigated. None of the animals showed symptoms of poisoning during the experiment. In different tissues and regions of the cerebrum and cerebellum the mercury residue levels ranged from 0.497 to 0.127 mg/kg, and a mercury concentration of 0.087 mg/kg was measured in the spinal cord. The mercury levels found in the liver, kidney, and lungs were in the respective ranges of 5.926-4.851 mg/kg, 18.037-1.728 mg/kg, and 0.683-0.528 mg/kg. Muscles contained 0.2-0.3 mg mercury per kg in rather uniform distribution.

74-2690. Doroshenko, P. N.; Zor'yeva, T. D.; Lutsenko, M. A. (Kiev Sci. Res. Inst. Otorhinolaryngology, Kiev, USSR). **O vliyanii tsidiala na slizistuyu obolochku verkhnihk dykhatel'nykh putey i nekotoryye sistemy organizma v eksperimente. [Effect of cidial on the mucous membrane of the upper respiratory tract and certain other systems in experimental animals.]** *Zh. Ushn. Nos. Gorl. Bolez. 33: 60-64; 1973.* (12 references) (Russian)

Histological alterations in the mucous membranes of the nose, larynx, and trachea were studied in rats exposed to cidial (phorate) in concentrations of 20 and 70 mg/m^3 for 4 hours, or 1.7 mg/m^3 for up to 4 months. About 50% of the animals exposed to the 70 mg/m^3 concentration died within 4 hr. In this group, focal desquamation of the columnar epithelium, proliferation of the cells of the tegumental epithelium, vascular dilation with hyperemia and lymphoid infiltration in the underlying connective tissue in the nose, and moderate desquamation and hyperemia in the larynx and trachea were observed. In another group exposed to cidial at 20 mg/m^3 for 4 hr, these pathological changes were less pronounced. In both groups, the histopathological changes were most pronounced in the central and anterior portions of the nasal cavity. Focal lymphoid infiltration of the mucous membrane, the presence of inflammation-generated infiltrates, and proliferation of the epithelial cells in the nose were observed in the chronic experiment after one month of exposure. The above changes were no longer present after 2.5 months of exposure. Liver cholinesterase activity was decreased by 22% after one month, and erythrocyte ChE was reduced after 2 months.

74-2691. Perscheid, M.; Schlueter, H.; Ballschmiter, K. (Inst. fuer Anorganische Chemie und Analytische Chemie, Johannes-Gutenberg-Universitaet, Mainz, Germany). **Aerober Abbau von Endosulfan durch Bodenmikroorganismen. [Aerobic degradation of endosulfan by soil microorganismms.]** *Z. Naturforsch. 28(11-12): 761-763; 1973.* (28 references) (German)

The aerobic degradation of the alpha and beta endosulfan isomers by soil microorganisms (*Pseudomonadaceae*) was studied in test solutions. The microorganisms were incubated in an endosulfan concentration of 4 ppm at 30°C for 14 days. Strong resorption of endosulfan by the bacteria at a rate of 90% was observed. The main metabolite of both isomers was determined as endosulfan alcohol by electron capture detector-coupled gas chromatography. In addition, the beta isomer yielded small amounts of the cyclic endosulfan ether and isomerized to the more stable alpha-endosulfan.

74-2692. Gingell, R.; Wallcave, L. (Eppley Inst. Res. Cancer, Univ. Nebraska Med. Cent., Omaha, NB 68105). **Species differences in the acute toxicity and tissue distribution of DDT in mice and hamsters.** *Toxicol. Appl. Pharmacol. 28(3): 385-394; 1974.* (27 references)

Orally administered DDT is acutely neurotoxic to the Swiss mouse and the Syrian golden hamster, but the latter is affected only at much higher doses. The central nervous system of each species is equally sensitive to DDT, since brain concentrations of DDT were similar after lethal doses. However, after an oral dose of 500 mg/kg, the DDT content of mouse brain was twice the value of that found in the hamster. This could not be explained by a species difference in absorption, metabolism or excretion of DDT, and is probably due to differences in the permeability of the blood/brain barrier

to DDT. When animals were maintained on 250 ppm dietary DDT for 6 weeks, the total fat and liver residues were 7-8 times higher in the mouse than in the hamster, the mouse liver containing relatively more DDE and the hamster more DDD (TDE). The rate of urinary excretion of radioactivity was similar in control animals after [^{14}C]DDT administration; dietary DDT pretreatment stimulated [^{14}C]DDT metabolism and excretion in the hamster but had little effect in the mouse. Mice also consumed 3 times more DDT-containing food/kg body weight than the hamster, and these differences account for the higher tissue residues in the mouse. The species differences in DDT metabolism and tissue metabolites are discussed with reference to the difference in tumorigenic response to DDT in the mouse and hamster. (Author abstract by permission)

74-2693. Chhabra, R. S.; Fouts, J. R. (Pharmacol. Toxicol. Branch, Nat. Inst. Environ. Health Sci., Nat. Inst. Health, Research Triangle Park, NC). **Stimulation of hepatic drug-metabolizing enzymes by DDT, polycyclic hydrocarbons or phenobarbital in adrenalectomized or castrated mice.** *Toxicol. Appl. Pharmacol. 28(3): 465-476; 1974.* (21 references)

Benzpyrene treatment in rats increases the hepatic microsomal aniline hydroxylase pH optimum from 7 to 8. In mice treated with benzpyrene, no such shift in pH optimum of aniline hydroxylase was observed. Further studies on hormonal regulation of ethylmorphine-*N*-demethylase, aniline and benzpyrene hydroxylase in mice indicated that adrenalectomy, castration or adrenalectomy plus castration do not lower the basal ("uninduced") activities of these enzymes (in rat with similar operations, basal activities are lowered by 50–90% depending on the enzyme). Also the magnitude of stimulation of hepatic microsomal drug metabolizing enzymes (HMDME) by pretreatment of mice with DDT, benzpyrene, 3-MC or phenobarbital in mice without adrenals, testes or both was not less than in sham-operated control mice (as occurs in rats), but instead was somewhat higher. These findings suggest that rats and mice differ in hormonal regulations of basal activities of HMDME and in the response of HMDME in animals pretreated with inducers of HMDME. (Author abstract by permission)

74-2694. Hayes, W. J., Jr. (Cent. Toxicol., Dept. Biochem., Vanderbilt Univ., Nashville, TN 37232). **Distribution of dieldrin following a single oral dose.** *Toxicol. Appl. Pharmacol. 28(3): 485-492; 1974.* (14 references)

Two groups of investigators have used the classical model for the distribution of thiopental following i.v. injection to predict the distribution of dieldrin following accidental ingestion. They concluded that the concentration of dieldrin in the brain is reduced first by redistribution to muscle and only later by redistribution to fat. The model as originally designed for thiopental had been evaluated by analysis of samples from persons undergoing surgery under thiopental anesthesia. Since it is not appropriate to give large doses of dieldrin to humans or to collect samples of muscle and various vital organs from them, the distribution of dieldrin was studied in rats. Dieldrin dissolved in corn oil was administered to these animals by stomach tube. The highest concentration of dieldrin in the brain was reached in 4 hr, and the concentration decreased gradually thereafter. The concentration in muscle remained essentially steady during the interval from 4 to 48 hr. There was no peak for muscle that could be interpreted as replacing a peak for brain. The concentration of dieldrin in fat was already slightly higher than that in the brain at 1 hr, very much higher at 4 hr when the concentration in the brain was maximal, and the concentration in the fat continued to increase during the first 24 hr. Either on the basis of concentration or on the basis of the total amount in each organ, no reason was found to assign any special importance to muscle as a sink into which dieldrin is redistributed from the brain. The fat appears to be far more important in this regard. The results indicate the danger of applying a mathematical model to a new situation without checking the results experimentally. (Author abstract by permission)

74-2695. Thomas, J. A.; Schein, L. G. (Dept. of Pharmacol., West Virginia Univ. Med. Cent., Morgantown, WV 26506). **Effect of parathion on the uptake and metabolism of androgens in rodent sex accessory organs.** *Toxicol. Appl. Pharmacol. 29(1): 53-58; 1974.* (10 references)

The daily oral administration of parathion (1.3, 2.6 or 5.3 mg/kg) had no effect upon the uptake and subsequent metabolism of [^{3}H]testosterone by the mouse prostate gland. These dose schedules also had no effect upon the ability of the prostate gland to biotransform labeled testosterone to its principal radiometabolites. Hepatic microsomes obtained from mice previously treated with parathion failed to reveal any alterations in their capacity to hydroxylate [^{3}H]-testosterone. Since the amounts of 6α, 7α and 16α-[^{3}H]hydroxytestosterone were unchanged by parathion treatment, androgen hydroxylase activity was not affected by this organophosphate pesticide. Although these polar radiometabolites remained unchanged by parathion pretreatment, [^{3}H]-androstanediol content was enhanced. [^{3}H]Dihydrotestosterone (^{3}H-DHT) and [^{3}H]androstendione formation from [^{3}H]testosterone by hepatic microsomes were not affected by parathion pretreatment. Various in vitro concentrations of parathion (4×10^{-7}, 4×10^{-6} or 2×10^{-5} M) significantly reduced the formation of ^{3}H-DHT in the mouse prostate gland, but not in the rat prostate gland. In the rat prostate, [^{3}H]androstendione concentrations were significantly increased by parathion in vitro. (Author abstract by permission)

74-2696. Lewis, T. R.; Perone, V. B.; Specht, H. D.; Smallwood, W. (Nat. Inst. for Occup. Safety and Health, Cincinnati, OH). **Dermal toxicity of triphenyltin chloride as affected by solvent and solvent temperature.** *Toxicol. Appl. Pharmacol. 29(1): 85-86; 1974.*

Triphenyltin chloride (TPTC) is a chemical precursor of triphenyltin hydroxide, an industrial bacteriostatic and fungistatic agent. In 1973, an industrial fatality occurred when a worker was drenched by a 1500-gallon slurry of TPTC spilled from an unbolted hatch of a mixing vessel. The present study was designed to evaluate the systemic and local effects that would result from dermal contact with TPTC under conditions of different solvents, solvent temperatures and skin cleansing agents. Forty-eight healthy male and female rabbits, weighing 1.8-2.6 kg, were assigned to a 2 X 2 X 3 factorial design consisting of the 12 possible combinations of (1) two solvents, water or heptane, (2) two temperatures for each solvent, 75° or 100°F, and (3) three skin cleansers, water, isopropyl alcohol or heptane. Acute primary skin irritation, tissue concentrations of tin in kidney, liver, heart, skin (2 layers) and body fat, hematological indices, and histopathology of the kidney, liver, spleen, skin and bone marrow were the biological parameters investigated. Skin irritation did not differ with solvent. Significant differences occurred among the cleansers with all 3 showing significant differences from one another; skin cleansed with water had the highest degree of irritancy and that with heptane the least. Abraded animals had higher tin content in the heart, both layers of skin, kidney and liver than did unabraded animals. Muscle and body fat had essentially the same tin content. When heptane was the solvent, increased concentrations of tin were noted in both layers of the skin, but were not demonstrable in the kidney, liver or heart. Data on cleanser effects on tissue tin concentration are equivocal. No hematologic alterations were noted. TPTC causes primary skin irritation consisting of erythema and edema. Furthermore, significant skin absorption occurs, particularly from abraded areas. (Author abstract by permission) (Thirteenth Annual Meeting of the Society of Toxicology, Abstract No. 27)

74-2697. Hartgrove, R. W., Jr.; Hundely, S. G.; Webb, R. E. (Dept. of Human Nutrition and Foods, Virginia Polytechnic Univ. and State Univ., Blacksburg, VA). **Comparative inductive effects of phenobarbital and endrin on liver microsomal activity in endrin-resistant and susceptible pine voles.** *Toxicol. Appl. Pharmacol. 29(1): 92; 1974.*

Previous studies in this laboratory have shown a correlation between the relative toxicity of endrin and hepatic microsomal mixed function oxidase (MFO) activity in endrin-susceptible and resistant pine voles. Endrin-resistant voles have been shown to have a greater capacity to metabolize benzpyrene and this capacity is heritable at least through the first generation. The resistance mechanism must be viewed as a complex phenomenon involving a genetic and an inductive aspect. This paper presents current findings on the relative inducibility of the hepatic mixed function oxidase system in the two strains. Voles were injected i.p, on 3 consecutive days with (1) 50 mg/kg phenobarbital (PB), or (2) 1 mg/kg endrin in Tween 80:saline (20:80) carrier, or (3) a sham of Tween 80:saline (20:80). Another group of resistant voles were treated with a dose that was equitoxic to susceptible voles. The voles were sacrificed 24 hr after the last treatment and MFO activity was determined by ethylmorphine (EM)-*N*-demethylation, aniline hydroxylation and P-450 content estimations. Induction with PB causes an increase in microsomal activity in both strains to an equal degree with both model substrate assays, as well as a marked increase in P-450 content above those values obtained for the sham injected controls. Endrin as it is administered in all these studies appears to cause no increase in microsomal MFO activity in either strain using the EM model substrate. P-450 content is decreased considerably, as is the proportion of the body weight represented by liver, as endrin is administered. The data for aniline, a type II substrate, hydroxylation does not in all cases follow the trends exhibited for EM *N*-demethylation. These results on first impression suggest that endrin does not induce microsomal activity. (Author abstract by permission) (Abstract No. 43)

74-2698. Grant, D. L.; Iverson, F.; Hatina, G. V.; Villeneuve, D. C. (Food Research Laboratories, Health Protection Branch, Ottawa, Ontario, Canada). **Effects of hexachlorobenzene on liver porphyrin levels and microsomal enzymes in the rat.** *Toxicol. Appl. Pharmacol. 29(1): 101; 1974.*

The present study was conducted to provide additional toxicological information on hexachlorobenzene (HCB), a very persistent fungicide. Male and female Wistar rats were fed diets containing HCB (0, 10, 20, 40, 80 or 160 ppm) for 274 days. A number of biochemical parameters and HCB residues in serum and liver were measured. The effect of sex on acquired porphyria was evident, as female and male rats receiving the 80 ppm HCB diet had 202 and 0.12 nmol porphyrin (calculated as coproporphyrin)/g liver. The HCB residues in liver were similar in males and females and dose-related. The liver:body weight ratio was increased in both sexes fed the 80 and 160 ppm diets. These two diets also caused decreased body weight gain of females. In vitro hepatic aniline hydroxylase and *N*-demethylase activities and cytochrome P-450 content were increased in males fed 40 ppm or more HCB but were unaltered in the females at all levels. However, pentobarbital sleeping time was decreased in female rats fed dietary levels of at least 20 ppm HCB. (Author abstract by permission) (Abstract No. 66)

74-2699. Kuiper-Goodman, T.; Grant, D.; Korsrud, G.; Moodie, C. A.; Munro, I. C. (Health and Welfare Canada,

Food Research Laboratories , Health Protection Branch, Ottawa, Ontario, Canada). **Toxic effects of hexachlorobenzene in the rat: correlations of electron microscopy with other toxic parameters.** *Toxicol. Appl. Pharmacol. 29(1): 101; 1974.*

This study was designed to investigate the effect of subacute feeding of diets containing the fungicide hexachlorobenzene (HCB) in the rat. The 700 male and female rats of the Charles River (COBS) strain were fed a diet consisting of Master Fox cubes with 4% corn oil to which was added HCB to give 0, 0.5, 2.0, 8.0 and 32.0 mg/kg body weight. Groups of 4 rats of both sexes were killed at 3, 6, 9 and 12 weeks of feeding and at various times after feeding with HCB was discontinued. Livers were excised for electron microscopy, for measurement of activity of drug metabolizing enzymes, HCB concentrations and porphyrin concentrations. Males showed a significant increase in liver weight which, after morphometric analysis of electron micrographs, was found to be mainly due to an increase in smooth endoplasmic reticulum. This was correlated to increased amounts of drug metabolizing enzymes at the two highest dose levels. The enzymes were at a maximum at 6 weeks after feeding of HCB and were still elevated 8 weeks after feeding of HCB had been discontinued. Sorbitol dehydrogenase, an indicator of liver damage, was maximal at 6 weeks in the serum of males. Histochemically, this was correlated to a depletion of this enzyme in the liver and a change in distribution of other enzymes was also noted. These effects were seen to a lesser extent in the females. Females were more sensitive than males to the lethal effects of HCB; in the highest dose group 26% of the females died and no males died. Females developed a more severe porphyria with very high porphyrin concentrations in the liver. These results indicate a sex difference in the response to HCB. (Author abstract by permission) (Abstract No. 67)

74-2700. Villeneuve, D. C.; Panopio, L. G.; Grant, D. L. (Food Research Laboratories, Health Protection Branch, Ottawa, Ontario, Canada). **Placental transfer of hexachlorobenzene in the rabbit.** *Toxicol. Appl. Pharmacol. 29(1): 108; 1974.*

Hexachlorobenzene (HCB) has gained significance as an environmental contaminant through its use as a fungicide and an industrial chemical. While information is available on the metabolism and distribution of this compound no data has been presented on its placental transfer. White, New Zealand rabbits were mated (day 0) and then orally treated with HCB from day 1 to day 27 with subtoxic doses of 0, 0.1, 1.0 or 10 mg/kg. On day 28 the dams were killed, fetuses excised and tissues removed. HCB content of maternal and fetal tissue was determined by GLC. HCB was found to cross the placenta and accumulate in the fetus in a dose-dependent manner. In the dams, the tissue with the highest HCB concentration was fat followed by liver, heart, kidney, brain, lung, spleen and plasma. In the fetus, liver concentrations were higher but brain concentrations lower than the corresponding maternal organs. No fetotoxic effects were observed at any of the dose levels. (Author abstract by permission) (Abstract No. 86)

74-2701. Khera, K. S. (Food Research Laboratories, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada). **Hexachlorobenzene: teratogenicity and dominant lethal studies in rats.** *Toxicol. Appl. Pharmacol. 29(1): 109; 1974.*

Hexachlorobenzene (HCB) was associated with large scale human poisoning in Turkey during the years 1955–1959. It has been detected in birds, fish, mussels and animal tissues (*Toxicol. Appl. Pharmacol.* 18: 994; 1971) and finds wide use as a fungicide on cereals. Its teratogenic and mutagenic potential in mammals is at present, not known. For teratogenicity evaluation rats were given single daily po doses of 0, 10, 20, 40, 60, 80 or 120 mg HCB/kg during 6-9, 10-13, 6-16 or 6-21 days of gestation; 80 and 120 mg/kg doses manifested maternal neurotoxicity and reduction in fetal weight. The incidence of uni- and bilateral 14th rib among fetuses was signficantly increased above control values when HCB was administered from days 10-13, 6-16 and 6-21 days of gestation. The incidence was related to the duration of treatment and the dose. Measures on live and dead fetuses, resorption sites, fetal weight and visceral and other skeleton anomalies were within control limits. For the dominant lethal test male rats distributed in 4 groups each of 15 males were dosed orally with 0, 20, 40 or 60 mg/kg for 10 consecutive days. Fourteen sequential mating trials (at each trial a male was caged with 2 virgin females for 5 days) were conducted. No significant differences in the incidence of pregnancies, corpora lutea, live implants and deciduomas in the test and control groups were seen. (Author abstract by permission) (Abstract No. 87).

74-2702. Dieter, M. P. (Patuxent Wildlife Research Center, Laurel, MD). **Influence of environmental contaminants on biochemical adaptation to stress in birds.** *Toxicol. Appl. Pharmacol. 29(1): 110-111; 1974.*

Adult Coturnix males (*Coturnix coturnix japonica*) were stressed by motion for 0.5-3 hr on a laboratory shaker operating at low or high speed. The extent of the stress was measured by elevations of plasma enzymes; the stress was not physically harmful, but was capable of eliciting major biochemical changes that were repeatable from one test to another. In 2-3 hr plasma creatine kinase and lactate dehydrogenase activities had increased 10-fold in birds shaken at high speed. Moreover, these plasma enzymes were increased proportionally to the amount of time the birds were stressed. There was also a doubling of aspartate aminotransferase activity in birds similarly stressed but this was not proportional to time on the shaker. Other

groups of birds were fed diets for 12 weeks containing 100 ppm Aroclor 1254, 4 ppm Morsodren (methylmercury dicyandiamide) or 165 ppm malathion, concentrations previously found to significantly elevate plasma enzyme activities. From the 9th through the 12th week, half of the birds on the contaminated feed and equal numbers on clean feed were shaken at low speed 1 hr/day for 5 days a week in an attempt to adapt the birds to the stress. Plasma enzyme responses in these 2 groups of birds were compared after 1 hr of shaking at high speed. Training almost entirely prevented the rise in plasma enzyme activities previously found in untrained birds shaken at high speed. For example, there was only 16.6% of the creatine kinase response to stress remaining in trained birds fed the clean diets. However, in trained birds fed Aroclor 1254, 49.3% remained, in those fed Morsodren 48.8% remained, and in those fed malathion 31.5% of the response to stress remained. Aspartate aminotransferase and lactate dehydrogenase responses to stress remaining were also 2-3 times greater in trained birds fed contaminants than in those on clean feed, suggesting that biochemical adaptation to stress was severely inhibited by ingestion of polychlorinated biphenyl, organophosphate or mercury. (Author abstract by permission) (Abstract No. 91)

74-2703. Mawdesley-Thomas, L. E.; Jolly, D. W.; Jenkins, G.; Bucke, D. (Huntingdon Res. Cent., Huntingdon, England). **The fish as a toxicological tool.** *Toxicol. Appl. Pharmacol. 29(1): 111; 1974.*

So often with traditional toxicological methods the possible hazards associated with the logarithmic increase in foreign compounds which are entering our environment may take months or years to be fully appreciated. Many of the foreign compounds which are produced are included under the general heading of insecticides and herbicides. As well as studying the efficacy and toxicity of these compounds on the pest species, it is possible to study their effects directly on wildlife. This is in contradistinction to pharmaceuticals, where in the majority of cases the animal data has to be extrapolated to man, and it is here that the problem arises. In wildlife studies one is able to study the effect of a compound on a species, and in this paper the fish is being considered, not only at the LD50 levels but also at the actual levels found in the environment. Fish toxicity testing has advanced considerably over the past 5 years and standard tests are made using the goldfish, catfish, bluegill, trout, and harlequin fish routinely. New methodologies in the field of dosimetry have been developed in these laboratories together with analytical techniques related to fish, the waters in which they are found, together with some advances in histological and histochemical principles. (Author abstract by permission.) (Abstract No. 93)

74-2704. Cammer, P. A.; Hollingworth, R. M. (Dept. of Entomol., Purdue Univ., West Lafayette, IN). **Dearylation of dialkyl *p*-nitrophenyl phosphates: a case of substrate specificity of mixed-function oxygenases.** *Toxicol. Appl. Pharmacol. 29(1): 114; 1974.*

The mixed-function oxygenase system (MFO) of mammalian liver microsomes is known to metabolize a large number of xenobiotics with a wide variety of structures. A high degree of structural specificity within a series of homologous compounds is not often observed. In this work the MFO of liver microsomes from mice is shown to exhibit such selectivity in the dearylation of certain dialkyl *p*-nitrophenyl phosphates (analogs of paraoxon). Microsomal pellets were prepared from phenobarbital-treated mice. Release of *p*-nitrophenol from a series of dialkyl *p*-nitrophenyl esters with alkyl groups ranging from 1 to 5 carbon atoms in length was measured spectrophotometrically. K*m* and V*max* values were determined for each substrate. Methyl and ethyl paraoxon were not readily metabolized by MFO. Though considerable dearylation of *n*-propyl paraoxon was observed, this activity was again lost with the *n*-butyl and *n*-amyl analogs. When the 2 alkyl substituents were not identical, only the compounds with a *n*-propyl group were metabolized in this manner. Dearylation of analogs with branched chains was generally successful with only the di-*s*-butyl and di-*i*-butyl forms. Certain modifications of the alkyl groups on ethyl paraoxon elicited dearylation. For instance, both di-(2-chloroethyl– paraoxon and di-(2-methoxyethyl) paraoxon proved to be good substrates, whereas di-(2,2,2,-trichloroethyl) paraoxon was not metabolized. The high degree of substrate specificity in this series appeared to be associated with the presence of a 3-carbon length or equivalent. (Author abstract by permission) (Abstract No. 101)

74-2705. Lech, J. J. (Medical College of Wisconsin, Milwaukee, WI). **Glucuronide formation in rainbow trout: effect of salicylamide on the acute toxicity, conjugation and excretion of 3-trifluoromethyl-4-nitrophenol.** *Toxicol. Appl. Pharmacol. 29(1): 115; 1974.*

In rainbow trout, the selective sea lamprey larvicide, 3-trifluoromethyl-4-nitrophenol (TFM) was previously found to be conjugated with glucuronic acid and excreted to a great extent in bile. In order to determine the degree and significance of conjugation of TFM in trout, studies utilizing salicylamide, an inhibitor of glucuronide formation, were carried out. Pre-exposure of rainbow trout to 25 mg/liter salicylamide decreased the LC50 of TFM from 5.05 to 2.67 mg/liter. Coincidental with the increase in toxicity were elevated blood concentrations of unconjugated TFM and a depression of TFM glucuronide in blood and bile. An increase in the concentration of unconjugated TFM was also found in brain, muscle and heart from salicyclamide-treated trout. Salicylamide increased the half-life of i.p. injected TFM from 1.59 to 4.13 hr and inhibited the glucuronidation of TFM by trout liver extracts in vitro. These studies indicate that glucuronide formation appears to be an

important mechanism in the protection of trout from the toxic effects of TFM and possibly other water-borne phenols. (Author abstract by permission) (Abstract No. 102)

74-2706. Hrdina, P. D.; Singhal, R. L.; Peters, D. A. V. (Dept. of Pharmacol., Univ. of Ottawa, Ottawa, Ontario, Canada). **Changes in brain biogenic amines and body temperature after cyclodiene insecticides.** *Toxicol. Appl. Pharmacol. 29(1): 119; 1974.*

The purpose of this study was to investigate whether exposure to organochlorine pesticides belonging to the cyclodiene group is capable of producing neurotoxic effects (tremor, convulsions and hyperthermia) and alterations in brain biogenic amines similar to those reported earlier for *p,p'*-DDT (*Toxicol. Appl. Pharmacol.* 25; 276; 1973). Following an acute dose of α-chlordane (200 mg/kg), endrin (50 mg/kg), heptachlor (200 mg/kg) or heptachlor epoxide (100 mg/kg) in rats, slight tremor, paralysis of hind legs and convulsive episodes were seen which were most pronounced during the 3rd and the 4th hr. In addition, treatment with these pesticides was found to produce hypothermia which was in sharp contrast to the marked increase in body temperature noted with *p,p'*-DDT. The α-chlordane-induced hypothermia was dose-dependent and the decrease in body temperature coincided with a fall in the concentration of brain-stem NE. While no changes were seen in brain-stem 5-HT, the concentration of ACh in cortex and striatum dropped to 72 and 73% of the control values respectively, 4 hr after pesticide administration. Treatment with α-methyl-*p*-tyrosine (100 mg/kg), while partially antagonizing the hypothermic response, failed to alter the other neurotoxic signs produced by α-chlordane. Chronic treatment (45 days) with small daily dose of endrin (0.5 and 2.0 mg/kg), heptachlor (3 and 15 mg/kg) or heptachlor epoxide (1 and 5 mg/kg) resulted in significant decreases in cerebro-cortical ACh, but failed to alter the concentrations of brain-stem NE. In contrast, significant increases in brain-stem 5-HT were noted with both doses of endrin and heptachlor. There were no apparent signs of neurotoxicity or any changes in body temperature in rats which received chronic treatment with either of these insecticides. It is suggested that while increased release and utilization of NE may be involved in the acute hypothermic effect of α-chlordane, the observed decrease in brain ACh is related to the convulsive episodes seen after acute treatment with this cyclodiene insecticide. (Author abstract by permission) (Abstract No. 113)

74-2707. Wagner, S. R.; Greene, F. E. (Dept. of Pharmacol., Milton S. Hershey Med. Cent., Pennsylvania State University College of Medicine, Hershey, PA). **Effects of acute and chronic dieldrin exposure on brain biogenic amines of male and female rats.** *Toxicol. Appl. Pharmacol. 29(1): 119; 1974.*

There have been numerous attempts to elucidate the etiology of neurotoxic manifestations of dieldrin in mammals (e.g., hyperexcitability, muscle fasciculations and clonic-tonic convulsions) by observing associated changes in brain neurochemistry. However, information regarding the possible effects of dieldrin on brain concentrations of norepinephrine (NE), dopamine (DA), and serotonin (5-HT) appears to be lacking. We have performed acute and chronic intoxication studies using adult male and female rats to determine not only if the brain concentrations of these biogenic amines were affected, but also whether sex differences were apparent. Five hr after an oral dose of dieldrin (50 mg/kg), severe neurotoxic signs were observed, especially in the male rat. This was accompanied by a 25% decrease of the whole brain NE content from the control value. NE contents were not significantly decreased in the female, and DA and 5-HT contents were not altered in either sex. Two days after a sublethal oral dose of dieldrin (40 mg/kg), no changes were observed in the whole brain contents of NE, DA and 5-HT. Whole brain values for NE, DA, and 5-HT were also measured after rats were maintained for 1, 2, 4, 6, 8 and 10 weeks on 50 ppm dieldrin in semi-synthetic diet. Although the brain contents of NE, DA and 5-HT in dieldrin-fed rats were frequently below control values after 4 weeks, these differences were seldom significant. Since regional fluctuations of these biogenic amines may have been masked in the whole brain estimations, a separate study was performed in which regions designated as midbrain (M), striatum (S), hippocampus (Hc), medulla-pons (MP), cortex and pooled cerebellum samples were analyzed after 1, 2, 4 and 8 weeks of feeding 50 ppm dieldrin. Significant differences were observed in NE contents in M, S, Hc and MP in both males and females which indicated that partial depletion occurred initially, followed by a return to normal values in subsequent weeks. Changes in 5-HT followed a similar pattern in M, S and MP, but were less significantly affected than NE in these regions. DA contents were unaffected. No obvious sex differences were noted in either of these chronic studies. It is concluded that dieldrin is capable of altering brain tissue concentrations of NE, DA and 5-HT under certain conditions and that sex differences are minimal. (Author abstract by permission) (Abstract No. 114)

74-2708. Minor, J. L.; Russell, J. Q.; Lee, C. C. (Pharmacol. and Toxicol., Midwest Res. Inst., Kansas City, MO). **Reproduction and teratology studies with the fungicide ferbam.** *Toxicol. Appl. Pharmacol. 29(1): 120; 1974.*

The reproductive and teratogenic effects of the fungicide, ferric dimethyldithiocarbamate (ferbam), were studied in rodents. Daily feeding, equivalent to 23, 66 or 109 mg/kg/day, to male rats for 13 weeks caused deaths and weight loss at the highest dosage without any effect on reproduction. Daily feeding, equivalent to 15

or 51 mg/kg/day, to females for 2 weeks caused a severe weight loss at the high dose and a slight, but not significant, decrease in neonatal survival. Ferbam, administered to rats on days 6–15 of gestation at dosage of 150 mg/kg/day resulted in some deaths, increased resorption, decreased fetal weight, and caused a slight increase in soft and skeletal tissue anomalies. Ferbam, administered to mice on days 6–14 of gestation at 30 or 300 mg/kg/day, failed to show any teratologic affect. These studies suggest that high doses of ferbam caused mild teratologic effects in rats. (Author abstract by permission) (Abstract No. 116)

74-2709. Preache, M.; Gibson, J. E. (Dept. of Pharmacol., Michigan State Univ., East Lansing, MI). **Enhancement of dinoseb-induced teratogenicity by maternal food deprivation in mice.** *Toxicol. Appl. Pharmacol. 29(1): 122; 1974.*

Dinoseb (2-*sec*-butyl-4,6-dinitrophenol), a commonly used herbicide, has teratogenic potential in mice at or near the dose levels required for maternal toxicity (Gibson, *Food. Cosmet. Toxicol.* 11: 31; 1973). Food deprivation was combined with dinoseb treatment to determine whether the teratogenicity would be altered. Pregnant mice were assigned to 1 of 4 groups that were either maintained on normal diet and treated with dinoseb (15.8 mg/kg/day, i.p.) or given a control injection of the vehicle on days 10-12, or were deprived of food but not water for 24 hr on the ninth day and given the dinoseb (15.8 mg/kg/day, i.p.) or control vehicle injections on the succeeding 3 days. The fetuses were removed by cesarean section on day 19 and were weighed, measured (crown-rump distance), and examined for external abnormalities. Mothers that received control injections, whether or not they were food deprived, produced litters in which greater than 95% of the fetuses were normal. Fetal weight and the proportion of normal fetuses/litter were decreased by dinoseb alone or in combination with food deprivation. Litters from dinoseb-treated mothers that had been food deprived had a higher incidence of anomalies than those of nondeprived mothers, but fetal weight was not further reduced by the deprivation. External anomalies included club feet, a reduction in the size of the fore limbs and the tail and absence of digits on both fore and hind limbs. Skeletal examinations indicated that the club foot anomaly was related to a reduction in size or absence of the tibia and also revealed a high incidence of fused ribs and vertebrae as well as the absence of digital bones. Soft tissue examinations most frequently revealed hydronephrosis sometimes accompanied by hydroureter. In conclusion, maternal food deprivation for 24 hr preceding dinoseb treatment altered dinoseb-induced teratogenicity by increasing the incidence of anomalies that were qualitatively the same as those observed with dinoseb alone. (Author abstract by permission) (Abstract No. 120)

74-2710. Bus, J. S.; Preache, M. M.; Gibson, J. E. (Dept. of Pharmacol., Michigan State Univ., East Lansing, MI). **Distribution, placental transfer and perinatal toxicity of paraquat in mice.** *Toxicol. Appl. Pharmacol. 29(1): 122-123; 1974.*

The purpose of this study was to examine the teratogenicity, placental transfer, maternal distribution, and postnatal toxicity of paraquat in Swiss-Webster mice. Paraquat, 1.67, 3.35 and 6.7 mg/kg i.p. or 20.0, 40.0 and 100.0 mg/kg p.o., was administered daily to pregnant mice on days 8-16 of gestation. Fetuses were examined for terata on day 19. Maternal distribution and placental transfer of paraquat was determined following administration of [^{14}C]paraquat, 20.0 mg/kg po, to pregnant mice on day 10 or 11 of gestation. Samples of maternal plasma, liver, lung and kidney plus placenta and embryo were collected at 0.25, 0.5, 1.0, 2.0 and 4.0 hr later and radioactivity was determined. In other experiments, paraquat was added at 50, 100 and 150 ppm in the water supply of pregnant mice starting at day 8 of gestation and continuing until the litters reached 42 days of age. Total litter body weights and mortality were recorded at 1-week intervals. A 100% maternal mortality was induced at 6.7 mg/kg i.p. and 40.0 and 100.0 mg/kg p.o. before day 16 of gestation was reached. Paraquat, 3.35 mg/kg i.p., significantly increased ($g < 0.05$) fetal resorptions (22.5 ± 3.5%) and was associated with high maternal mortality. Paraquat, 1.67 and 3.35 mg/kg i.p. and 20.0 mg/kg p.o., slightly increased gross, soft tissue and skeletal anomalies. Radioactivity after [^{14}C]paraquat was highest in liver and kidney, followed by lung, placenta and plasma. Radioactivity in the embryos reached maternal plasma values 2 hr after [^{14}C]paraquat but was low at all other times. Paraquat at 50 and 100 ppm did not alter neonatal growth rate compared to controls; however, 100 ppm paraquat increased neonatal mortality to 67%. The level of 150 ppm was lethal to the dams within 20 days after initiation of treatment. Despite low paraquat teratogenicity which may be due to low levels of paraquat reaching the embryo, postnatal mortality of mice receiving paraquat throughout perinatal development was high. (Author abstract by permission) (Abstract No. 121)

74-2711. Norman, B. J.; Neal, R. A. (Cent. in Environ. Toxicol., Dept. of Biochem., Vanderbilt Univ. School of Med., Nashville, TN). **An examination of the in vitro metabolism of parathion in rat lung and brain.** *Toxicol. Appl. Pharmacol. 29(1): 125; 1974.*

Although in a quantitative sense the liver is the major organ involved in the metabolism of parathion to its toxic oxygen analog, paraoxon, extrahepatic metabolism of parathion to paraoxon may play a more important role in the toxicity of this pesticide. We have therefore undertaken studies examining the lung and brain of the rat for its ability to metabolize parathion to paraoxon. These studies have indicated that on the basis of the protein content of the "microsomal fractions" the

rat lung metabolizes parathion to paraoxon at a rate that is approximately 10% of rat liver. These studies have also revealed that the "microsomal fraction" from rat brain can metabolize parathion to paraoxon at a rate that is about 3% that seen with microsomes isolated from the liver. The metabolism of parathion to paraoxon using "microsomes" isolated from rat lung and brain has been shown to require the presence of NADPH and is inhibited by carbon monoxide. The metabolism of parathion to paraoxon by rat lung and brain does not appear to be increased by prior treatment of the animals with phenobarbital or 3-methylcholanthrene. The apparent K*m* for the metabolism of parathion to paraoxon by "microsomes" isolated from the lung appeared to be significantly lower than the apparent K*m* for this reaction catalyzed by rat liver microsomes. The apparent K*m* for metabolism of parathion to paraoxon by "microsomes" isolated from the brain appears to be very similar to that for liver microsomes. The results of these studies indicate there is a low but significant rate of metabolism of parathion to paraoxon in the rat lung and brain. (Author abstract by permission) (Abstract No. 127)

74-2712. Benke, G. M.; Murphy, S. D. (Dept. of Physiol., Harvard School of Public Health, Boston, MA) **The influence of age and sex on the toxicity and multiple pathways of metabolism of methyl parathion and parathion in rats.** *Toxicol. Appl. Pharmacol. 29(1): 125; 1974.*

Methyl parathion (MPS) and parathion (PS) are 2 widely used organophosphorus insecticides. The literature reveals that there are marked age and sex differences in LD50 values for rats for MPS and PS. The present investigation of multiple pathways of metabolism of these compounds in vitro was undertaken in an attempt to explain these differences. The following pathways were studied: oxidative cleavage to *p*-nitrophenol and the corresponding dialkylthiophosphate; activation to the oxygen analog; glutathione-dependent degradation of MPS and PS; and hydrolysis and binding of methyl paraoxon (MPO) and paraoxon (PO). Livers of male and female Holtzman rats 1, 12, 24, 37 and 60 days old were used to determine changes in enzyme activity occurring during this period, and LD50 values (ip) were also determined for both sexes at each age. For both compounds there was a direct correlation of LD50 with age, i.e., older animals were less susceptible. In adult females the LD50 for MPS and PS was 8 and 3 respectively, while in males the LD50 was 5.8 for both compounds. The calculated ratio of rates of oxidative cleavage/activation in adult male livers for both insecticides was equal (1.34) while in females for MPS it was 1.75 and for PS 0.94. The ratio was lower with the younger animals, indicating a lesser tendency for the liver to cleave than activate the parent insecticide. Liver and plasma of younger animals were also less able to hydrolyze MPO and PO by A-esterases. Glutathione-dependent detoxification was lower in 1- and 12-day-old male and female rat livers, but there was little difference between weanlings and adults. Liver and plasma of younger rats, especially 1- and 12-day-olds, also had much less capacity to bind MPO and PO. These results indicate that several alternate pathways of metabolism must be considered in attempted correlations with age and sex differences in toxicity. (Author abstract by permission) (Abstract No. 128)

74-2713. Chow, A. Y. K.; Murphy, S. D. (Dept. of Physiol., Harvard School of Public Health, Boston, MA). **Propanil-induced methemoglobin formation in relation to its metabolism in vitro.** *Toxicol. Appl. Pharmacol. 29(1): 125-126; 1974.*

Previous studies in this laboratory showed that i.p. administration of the herbicide, propanil (3-4-dichloropropionanilide) produced methemoglobin in mice. In this study, we compared species and sex differences in the metabolism of propanil in relation to its methemoglobin production in vivo. Adult male and female mice, rats and guinea pigs were given single i.p. doses (1.83 mmol/kg) of propanil and methemoglobin concentrations (as percent total hemoglobin; % MHb) were determined at intervals of 0.5-3 hr. Three hr after propanil, the mean % MHb values in male mice, rats and guinea pigs were 53.9, 50.1 and 5.1 respectively. The corresponding values for females were 28.3, 65.1 and 5.0. Parallel studies using equimolar doses of 3,4-dichloroaniline (DCA), a hydrolytic metabolite of propanil, showed no sex differences in methemoglobinemic response in any species; the % MHb values 3 hr after DCA in male mice, rats and guinea pigs were 33.4, 62.3 and 15.2. Of 9 tissues assayed for acylamidase activity only liver and kidney hydrolyzed propanil. Male mice had significantly higher liver and kidney acylamidase activity than females which may explain the sex difference in propanil-induced methemoglobinemia in this species. The resistance of guinea pigs to propanil methemoglobinemia was not due to low acylamidase activity. The relative capacities of NADP-glucose 6-PO_4-fortified liver homogenates from both sexes of each species to activate DCA to methemoglobin-producing metabolites were compared using an in vitro system. Livers from mice and guinea pigs were about equally active in producing methemoglobin forming metabolites from DCA, while rat livers were less effective. Sex differences in liver capacity to activate DCA were not observed in mice and guinea pigs, but male rat livers were more active than female rat livers. These results are in contrast to those expected from the in vivo studies with DCA suggesting that other factors such as species differences in methemoglobin reduction may be involved. (Author abstract by permission) (Abstract No. 129)

74-2714. Hayes, J. R.; Hartgrove, R. W.; Hundley, S. G.; Campbell, T. C.; Webb, R. E. (Dept. of Biochem. and

Nutr., Virginia Polytechnic Inst. and State Univ., Blacksburg, VA). **Interaction of endrin and dieldrin with hepatic microsomal cytochrome P-450.** *Toxicol. Appl. Pharmacol. 29(1): 126; 1974.*

The kinetic parameters for binding of endrin to hepatic microsomes were determined for two strains of the vole (*Pitymys penetorum*) resistant (R) and susceptible (S) to the toxicity of endrin, respectively. The LD50 values were 18.9 and 2.6 mg/kg for the R and S strains, respectively (Petrella and Webb, *Fed. Proc.* 32: 320Abs.; 1973). Endrin produces type I binding when added to microsomes of either strain. No significant differences were observed between the binding kinetics for these two strains. The *K*s (spectral dissociation constant) values were 5.6 ± .7 μM (R) and 4.4 ± 0.4 μM (S); the ΔA max/mg protein values were 0.045 ± 0.007 (R) and 0.051 ± 0.001 (S); and the ΔA max/nmol cytochrome P-450 measurements were 0.029 ± 0.004 (R) and 0.035 ± 0.002 (S). Therefore, the capacity of microsomes to bind endrin was not related to the endrin resistance exhibited by these 2 strains. Since metabolism of endrin by these 2 strains also differs significantly (Petrella and Webb, *Fed Proc.* 32: 320Abs.; 1973), the absence of a difference in binding may indicate that binding and catalytic kinetic parameters are not related in the microsomes of this species. Dieldrin, the stereoisomer of endrin, known to differ in its toxicity between these 2 strains only approximately 2-fold, also showed no difference in its binding to microsomes. (Abstract abstract by permission) (Abstract No. 130)

74-2715. Byard, J. L.; Koepke, U. C.; Abraham, R.; Golberg, L.; Coulston, F. (Inst. of Comparative and Human Toxicol., Albany Med. Coll., Albany, NY). **Biochemical changes produced in the liver by mirex.** *Toxicol. Appl. Pharmacol. 29(1): 126-127; 1974.*

In a study of the hepatic effects of Mirex, Charles River CD-1 mice were fed 1–90 ppm Mirex in the diet for periods ranging from 5 days to 13 months, Swiss Webster, BALB/c and C57 mice were fed 15 ppm Mirex for 4 months, and Sprague Dawley rats received 5 and 30 ppm Mirex for 13 and 9 months respectively. At regular intervals, heavy mitochondrial, light mitochondrial, microsomal and soluble fractions were prepared from livers of 2–6 animals/group. Measurement of DNA, protein, respiration, oxidative phosphorylation, mixed function oxidase, glucose-6-phosphatase and diene conjugates were carried out. Mirex stimulated an increase in relative liver weight which was slight at 1 ppm and 230% of the control value at 30 ppm. The protein in each liver fraction increased in approximate proportion to the increase in relative liver weight. Mixed function oxidase activity and cytochrome P-450 were stimulated several-fold in all livers. The total DNA content of the liver was elevated 120-360%, and tended to increase as the level of Mirex and the duration of feeding increased. While the amount of DNA in the liver increased, the DNA concentration decreased, indicating that new protein resulted from stimulation of RNA and/or protein synthesis as well as DNA synthesis. Respiration in the light mitochondrial fraction was stimulated 2- to 3-fold by Mirex. In comparison with controls, the mitochondria in this fraction has a more intact inner membrane, as measured by permeability to NADH, and a tighter coupling of oxidative phosphorylation to respiration. Decreased glucose-6-phosphatase activity was not associated with lipid peroxidation since the concentration of diene conjugates was unchanged. No marked sex differences were observed in the biochemical parameters in Charles River CD-1 mice. Strain differences were not evident in male Swiss Webster, BALB/c, C57 or CD-1 mice fed 15 ppm Mirex for 2 and 4 months. At comparable doses and lengths of exposure, the biochemical parameters were much less changed in rats than in mice. (Author abstract by permission) (Abstract No. 131)

74-2716. Chadwick, R. W.; Freal, J. J. (Environ. Prot. Ag., Nat. Environ. Res. Cent., Primate Pestic. Effects Lab., Research Triangle Park, NC). **Comparative lindane metabolism and enzyme induction in rats pretreated with eight different chlorinated pesticides.** *Toxicol. Appl. Pharmacol. 29(1): 127; 1974.*

Barbiturates and miscellaneous drugs, including organochlorine pesticides, are believed to bring about a generalized nonspecific induction of microsomal enzymes through similar mechanisms. However, previous work indicates that the metabolism of toxicant may be selectively altered by pretreatment with different pesticides and drugs. This study compares the effect of pretreatment with one of eight organochlorine pesticides on the metabolism of lindane and on the activity of various hepatic microsomal enzymes in the rat. Forty-eight weanling, female rats were randomly assigned to 1 of 8 treatment groups and received daily oral injections of 1 mg of either chlordane, DDT, hexachlorobenzene, Mirex, Penphene (tetrachlorothiophene), Pentac [decachlorobis (2,4-cyclopentadien-1-yl)], toxaphene or just peanut oil. On the eighth day all animals received 1.7 mg of lindane (containing 1.49 μCi of [^{14}C] lindane) in place of their previous treatment and they were sacrificed at 24 hr later. In general, DDT, Mirex, chlordane and hexachlorobenzene appear to be the most effective inducing agents followed by toxaphene, Pentac and Penphene. However, while the in vitro activity of various microsomal enzymes was increased to the greatest extent by pretreatment with Mirex, the metabolism of lindane was significantly highest in the animals receiving DDT. DDT and hexachlorobenzene pretreatment resulted in the excretion of more free chlorophenols and neutral metabolites, while Mirex and chlordane stimulated the excretion of more conjugated chlorphenols and highly polar metabolites. DDT was unique in stimulating the excretion of the metabolite 2,3,4,5-tetrachlorophenol. The results of this study indicate the possibility of rather selective enzyme

responses to certain organochlorine pesticides and suggest that these compounds may induce microsomal enzymes through dissimilar mechanisms. (Author abstract by permission) (Abstract No. 132)

74-2717. Hundley, S. G.; Hartgrove, R. W., Jr.; Webb, R. E. (Dept. Biochem. and Nutr., Virginia Polytechnic Inst. and State Univ., Blacksburg, VA). **Transfer of endrin via milk in endrin-susceptible and resistant pine mice and the resultant effects on liver microsomal activity in the neonate.** *Toxicol. Appl. Pharmacol. 29(1): 127-128; 1974.*

Many lipophilic pesticides are known to be transferred to offspring via mother's milk. The present study was conducted to determine the transfer of endrin from dam to pup in endrin susceptible and resistant pine mice and to compare the activity of the hepatic mixed function oxidase (MFO) system in pups from dams treated with or without endrin. Dosing of the dams with endrin began 1 day after birth with either (1) oral doses of endrin in corn oil or (2) a mixture of endrin in ground lab feed. The total amount of endrin present in the whole pup was determined by gas chromatography. MFO activity was determined in 2.5-week-old pups on the basis of maximal activity of ethyl morphine *N*-demethylase and aniline hydroxylase. No difference was observed in the amount of endrin present in pups from endrin-resistant and susceptible dams maintained on an identical endrin dosing schedule. Though a decrease in MFO activity was seen in pups from either endrin-resistant or susceptible dams treated with endrin as compared to the activity in pups from dams maintained on a normal diet, the magnitude of decrease was greater in pups from endrin-susceptible dams. (Author abstract by permission) (Abstract No. 133)

74-2718. Greene, F. E.; Stevens, J. T.; Soliman, M. R. I.; Oberholser, K. A. (Dept. Pharmacol., M. S. Hershey Med. Cent., Pennsylvania State Univ., Hershey, PA). **Effects of perinatal dieldrin exposure on hepatic microsomal enzymes of immature and adult rats.** *Toxicol. Appl. Pharmacol. 29(1): 128; 1974.*

There have been numerous studies concerning the effects of intrauterine exposure to insecticides on the activity of hepatic drug metabolizing enzymes in the neonate. However, little data is available on the long-term effects of such exposure. We have examined the effects produced by feeding a semi-synthetic diet containing 50 μg/gm of dieldrin to SD rats during the last week of pregnancy on certain hepatic microsomal cytochrome P-450-dependent pathways at 1, 5, 14, 21 and 42 days of age. Metabolism of [^{14}C]dieldrin was also examined in adult animals. As expected, microsomal P-450 concentrations were higher in offspring of dieldrin-exposed mothers. Differences appear to reach maximum at 5 days when control values were 0.21 ± 0.03 nmol P-450/mg and values in exposed rats 0.60 ± 0.06 nmol P-450/mg. At 14 days these values were 0.60 ± 0.01 nmol/mg and 1.40 ± 0.16 nmol/mg in perinatally exposed rats. Significant differences in P-450 values were also seen at 21 but not at 42 days. Ethylmorphine *N*-demethylase (ETM) activity paralleled differences in P-450 concentrations at 5 and 14 days, but differences between perinatally exposed and control rats were no longer significantly different at 21 days of age. The sustained induction is probably the result of continuous ingestion of small amounts of dieldrin during nursing. At 42 days of age the P-450-dependent system, as measured by ETM and aniline metabolism, NADPH oxidase and NADPH cytochrome c reductase activity, was identical in the perinatally exposed and control groups. There were, however, small but significant differences in fatty acid composition of the microsomal membranes. Perhaps the most significant effect produced by perinatal dieldrin exposure is permanent impairment of dieldrin metabolism. In a typical experiment the rate of [^{14}C]-dieldrin metabolism was 35.5 ± 3.8 pmol/mg microsomal protein/min in control and 24.1 ± 2.4 pmol/mg microsomal protein/min in 6-week-old perinatally exposed male rats. These results demonstrate that perinatal exposure to common environmental contaminants such as dieldrin may produce both reversible and irreversible changes in hepatic microsomal enzymes. (Author abstract by permission) (Abstract No. 134)

74-2719. Abraham, R.; Koepke, U. C.; Golberg, L.; Coulston, F. (Inst. of Comp. Human Toxicol., Albany Med. Coll. Albany, NY). **Individual and combined effects of mirex and polychlorinated biphenyls on mouse liver cells.** *Toxicol. Appl. Pharmacol. 29(1): 128-129; 1974.*

Liver enlargement, proliferation of smooth endoplasmic reticulum and increases in microsomal enzymes are common hepatic responses of rodents to the administration of single polychlorinated compounds, but little is known regarding the combined effects of 2 such compounds. A study was therefore undertaken of a mixture of polychlorinated biphenyls (PCB) (Aroclor 1254) and Mirex in Charles River CD-1 mice. The compounds were administered in the diet at the following levels for 7 days: group I, chow; group II, PCB 500 ppm; group III, Mirex 90 ppm; and group IV, Mirex 90 ppm and PCB 500 ppm. Loss of body weight, increases in liver weight and demethylase activity were recorded in all 3 experimental groups, being most pronounced in group IV. Glucose 6-phosphatase activity was decreased in groups II and III and remained unchanged in group IV. In mice of group IV there were striking structural changes in hepatic lysosomes, with formulation of large myeloid bodies (lysosomes containing cellular debris) and numerous autophagic vacuoles that were PAS-positive and stained for acid phosphatase. These changes were reflected in the elevated activities of both total and sedimentable acid phosphatase. The lysosomes were normal in all other groups. Further changes included loss of

glycogen in groups III and IV and hepatic cell necrosis in group IV. The capacity of the combination of toxicants to elicit unique lysosomal responses posed questions regarding the biological interaction between environmental chemicals. (Author abstract by permission) (Abstract No. 135)

74-2720. Baetcke, K. P.; Peoples, A.; Cranmer, M. F.; Gaylor, D. L. (National Center for Toxicological Research, Jefferson, AR). **Statistical analyses of clinical biochemistry data obtained from the Pesticide Community Studies.** *Toxicol. Appl. Pharmacol. 29(1): 133; 1974.*

A quality control program (intra- and interlaboratory) was instituted in conjunction with the EPA Pesticide Community Studies to ensure standarization of methodologies from laboratory to laboratory and to permit accurate determination of biological variation in the human population based on clinical biochemistries. The clinical tests conducted by the 13 participating laboratories included determinations of cholesterol, total protein, albumin, uric acid, glucose, BUN, serum creatinine and phosphorus. Means, SD and coefficients of variation were determined for each test on data collected during 13 test periods in 1972. The average coefficient of variation for all test periods exceeded 10% for normal serum creatinine only; variation of all other tests averaged 6–7%. Similar statistical data was collected on clinical biochemistries obtained on human participants in the long-term studies of the Community Studies program. It was found that biological variation exceeded analytical variation by as much as a factor of 11:1. A combination of analytical variation, based on quality control data, and biological variation, based on chemistries of human subjects, was utilized successfully to predict the chemical differences required between human populations for the differences to be statistically significant. Such information can be utilized to ascertain which clinical tests are the most appropriate for detecting effects of chronic exposure to chemical insult by the human population and to determine when analytical methodology R & D is desirable. (Author abstract by permission) (Abstract No. 148)

74-2721. Plank, J. B.; Lindberg, D. C.; Kennedy, G. L.; Keplinger, M. L.; Calandra, J. C.; Stone, J. D. (Industrial BIO-TEST Laboratories, Inc., Northbrook, IL). **Toxicology of USB 3584.** *Toxicol. Appl. Pharmacol. 29(1): 133; 1974.*

Studies have been conducted to define the general toxicologic properties of USB 3584 (N^3, N^3-diethyl-2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine) and of its 25% emulsifiable concentrate formulation. Investigations included a battery of acute and subacute studies in rats, rabbits, fish, wild birds and chicks, subacute feeding studies in mice and rats, a dominant lethal mutagenic study in mice, and a teratologic study in rabbits. The USB was relatively non-toxic in acute studies, but the formulation was severely irritating to rabbit eyes upon unlimited contact and to rabbit skin upon repeated contact under occlusive conditions. Eye irritation was greatly diminished by washing after a 4-sec contact. In 90-day feeding studies, 600 ppm was a no-effect level in both rats and dogs. At 2000 ppm, both rats and dogs experienced body weight depressions, rats showed liver weight elevations and dogs showed a moderate anemia. No evidence was obtained to indicate cataractogenic, mutagenic, teratologic or carcinogenic activity for USB 3584. (Author abstract by permission) (Abstract No. 149)

74-2722. Kennedy, G. L; Keplinger, M. L.; Fancher, O. E.; Calandra, J. C.; Stone, J. D. (Ind. BIO-TEST Lab., Inc., Northbrook, IL). **Metabolic studies with USB 3584.** *Toxicol. Appl. Pharmacol. 29(1): 134; 1974.*

A metabolic study with [^{14}C]USB 3584 (N^3, N^3-diethyl-2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine) in albino rats showed that the compound is rapidly and extensively metabolized. Unaltered USB 3584 was detected only in the feces. Chromatographic analysis suggested the occurrence of multiple metabolites in both feces and urine. None of these were identified. Tissue concentrations of USB 3584 and/or its tagged metabolites were low, estimated total recoveries from all tissues being 1.5–1.7% calculated as unaltered USB 3584. Treatment of a dairy cow with a single dose of [^{14}C]USB 3584 after preconditioning with the unlabeled compound, at levels corresponding to 0.3 ppm in the total diet in each case, gave no detectable concentrations of radioactivity in whole milk and barely detectable levels in the concentrated lipid fraction. The ^{14}C activity of all tissues was below the detection limit of 0.36 ppb for 150-mg samples. Only liver samples had counts of 1–3 above background. Exposure of bluegill sunfish to [^{14}C]USB 3584 revealed no accumulation of residues in fish tissue and the retained residues were rapidly cleared upon termination of exposure. (Author abstract by permission) (Abstract No. 150)

74-2723. Jenkins, D. H.; Plank, J. B.; Keplinger, M. L.; Calandra, J. C. (Ind. BIO-TEST Lab., Northbrook, IL). **Toxicity and reproduction studies in quail and ducks with dieldrin and USB 3584.** *Toxicol. Appl. Pharmacol. 29(1): 134; 1974.*

Subacute dietary LC50 values of USB 3584(N^3,N^3-diethyl-2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine) in Mallard ducks and bobwhite quail were determined to be >1000 and >5000 ppm respectively. Quail showed decreased food consumption and weight depression at dietary levels of 5000 ppm and higher over the 5-day period of treatment. The 5-day LC50 for dieldrin in quail was found to be 54 ppm. Reproduction studies were conducted in young adult ducks and quail at dietary levels of 10 and 30 ppm with

USB 3584 and at 3 ppm with dieldrin. Treatment began 6 and 12 weeks prior to collecting eggs for hatching for ducks and quail respectively. There was no evidence of toxic effects upon parental animals from any treatment. The USB 3584 caused no adverse effects with respect to egg production or quality, shell thickness, hatchability, weight and viability of progeny and incidence of progeny abnormalities. Dieldrin slightly decreased the hatchability of eggs from ducks and appeared to slightly decrease the 14-day viability of quail chicks.

74-2724. Highman, B.; Schumacher, H. J. (Nat. Cent. Toxicol. Res., Jefferson, AR). **Pathologic effects of a preparation of 2,4,5-trichlorophenoxyacetic acid on maternal mice.** *Toxicol. Appl. Pharmacol. 29(1): 134; 1974.*

To study the possible teratologic and pathologic effects of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), several strains of maternal mice were sacrificed for pathologic study at intervals during peroral treatment with this compound. Beginning 6 days after mating, the mice received on 9 successive days 30–120 mg/kg of 2,4,5-T dissolved in 0.2 ml of a 1:9 mixture of acetone and corn oil. This report concerns the effect of this preparation on C57BL/6 and CD-1 maternal mice. Pathologic findings were found in all treated groups of maternal mice but were most frequent and severe in mice that died or were sacrificed after 4-8 doses of 120 mg/kg of 2,4,5-T. Over 50% of these maternal mice showed myocardial lesions, and a great majority showed depletion of lymphocytes in the thymus, spleen or lymph nodes and hypocellularity of the bone marrow. Many developed bronchopneumonia and other severe secondary infections. The possibility that some of these lesions may be due to dioxins or other contaminants in the current preparation cannot be excluded and is under study. (Author abstract by permission) (Abstract No. 152)

74-2725. Thomas, J. A.; Mawhinney, M. G. (Dept. of Pharmacol., West Virginia Univ. Med. Cent., Morgantown, WV). **Failure of parathion to alter male mouse reproductive organ activity.** *Toxicol. Appl. Pharmacol. 29(1): 134-135; 1974.*

Recent reports from this laboratory revealed that certain of the organochloride pesticides (e.g. DDT or dieldrin), but not carbaryl, can reduce the metabolism of androgens in sex accessory organs of the male mouse. Parathion (1.3, 2.6 and 5.2 mg/kg daily X 5-po), like carbaryl, failed to interfere with the assimilation of [1-^{3}H] testosterone (T-^{3}H) by the prostate gland. These dose regimens had no effect upon testicular weights or upon prostate gland weights. The metabolism of T-^{3}H to its major radiometabolites by either the prostate gland or by hepatic microsomes revealed few parathion-induced changes in these tissues. Parathion-induced alterations in the formation of testosterone polar radiometabolites (e.g. 6-β, 7-α or 16-α hydroxytesterone-^{3}H), unlike DDT or dieldrin, were not particularly evident following the 5-day treatment period with this organophosphate. In general, these studies reveal that despite the relative high acute toxicity of the organophosphate-type pesticide, they are not as likely as the organochlorides to produce alterations in male reproductive organs. (Author abstract by permission) (Abstract No. 153)

74-2726. Felsenstein, W. C.; Smith, R. P.; Gosselin, R. E. (Dartmouth Med. Sch., Hanover, NH). **Toxicological studies on the avicide 3-chloro-*p*-toluidine.** *Toxicol. Appl. Pharmacol. 29(1): 135; 1974.*

3-Chloro-*p*-toluidine (3-CPT) induced methemoglobinemia when given in lethal doses to mice and rats, but not when given to chickens. In mice the i.p. LD50 for 3-CPT (hydrochloride salt) was 1.9 mmol/kg with 95% confidence limits of 1.7 and 2.1. Death in laboratory rodents, however, appeared to be unrelated to the methemoglobinemia. Peak values were moderate and had declined to low but persistent levels at time of death, which occurred in hours or several days in rats and mice, respectively. Heinz bodies appeared at 30 hr but there was no evidence of hemolysis. Blood concentrations of 3-CPT in fatally poisoned mice appeared to decrease linearly with time. The estimated half-life was 6.6 hr. In mice methemoglobinemia was attenuated, but mortality increased by methylene blue. Hyperbaric oxygen increased and ANIT decreased methemoglobinemia without affecting mortality; hypoxia had no effect on the latter. Cyanosis persisted after return of methemoglobinemia to low values and was not relieved by hyperbaric oxygen. No significant amounts of inactive pigments other than methemoglobin were found. Mortality in mice after 3-CPT was increased by cold stress or contemporaneous administration of Dial-Urethane. A profound and persistent hypothermia in mice and rats occurred after 3-CPT and mice showed a dramatic, transient decrease in pulmonary ventilation. Elevated ambient temperatures partially blocked the hypothermic response but, at least in mice, warming did not prevent death. In species resistant to 3-CPT methemoglobinemia death appears to be due to an uncharacterized block of energy metabolism. (Author abstract by permission) (Abstract No. 154)

74-2727. Street, J. C.; Sharma, R. P. (Dept. of Anim. and Vet. Sci., Utah State Univ., Logan, UT). **Quantitative aspects of immunosuppression by selected pesticides.** *Toxicol. Appl. Pharmacol. 29(1): 135-136; 1974.*

Dose-response evaluations of immune suppression by 4 insecticides were made using rabbits. Test compounds (*p,p'*-DDT, methyl parathion, carbaryl and carbofuran), were given orally by means of treated feed, during a 28-day pretreatment period. Antigens were administered on day 29 into the foot pad (sheep

erythrocytes plus Freund's complete adjuvant) and the status of the immune systems were evaluated over the following 28 days while continuing chemical treatments. The most sensitive indicator of immune suppression was a histological test of fluorescent anti-rabbit globulin-binding by sections of popliteal lymph node. By that test, significant suppression was observed with doses as low as 0.92 mg/kg DDT, 0.04 mg/kg methyl parathion and 0.49 mg/kg carbofuran. Supporting evidence of suppression was observed as reductions in germinal centers in spleen as well as thymus cell cortical atrophy. Methyl parathion and DDT apparently suppressed cell-mediated sensitivity to tuberculin although higher dosages were required. In contrast, hemolysin and hemagglutinin titers were not systematically affected by dosages of any chemical up to 40-fold over those producing histological effects. Serum globulin values were also unaffected. Carbaryl, at dosages up to 8.38 mg/kg, gave no consistent indications of suppression in these studies. These observations confirm previous reports of immune suppression by insecticides such as DDT, an effect which can now be extended to additional pesticidal chemicals as indicated by the results obtained with the organophosphate and carbamate compounds studied. (Author abstract by permission) (Abstract No. 155)

74-2728. Albert, J. R.; Stearns, S. M. (Shell Develop. Co., Modesto, CA). **Delayed neurotoxic potential of a series of alkyl esters of 2,2-dichlorovinyl phosphoric acid in the chicken.** *Toxicol. Appl. Pharmacol. 29(1): 136; 1974.*

The absence of any delayed neurotoxic effect in the chicken has been reported for dimethyl 2,2-dichlorovinyl phosphate (dichlorvos). Replacement of 1 methyl group with an ethyl, isopropyl, pentyl or chloroethyl substituent results in chemicals with reported neurotoxic potential (Aldridge and Johnson, 1971; Aldridge and Barnes, 1966). In this study *bis* and C_1Cn n-alkyl and C_1, chloroethyl esters of 2,2-dichlorovinyl phosphoric acid were tested in the 14- to 17-month-old hen for their delayed neurotoxic potential. The oral LD50 values in mg/kg determined for mixed C_1,Cn n-alkyl esters were C_1,C_1 (dichlorvos): 11.4 ± 1.4; C_1,C_2: 3.4 ± 1.0; C_1,C_3: 3.4 ± 0.6; C_1,C_4: 2.6 ± 0.6; C_1,C_5: 6.9 ± 1.1; C_1,C_6: 21.1 ± 4; C_1,C_7: 50 ± 2; C_1,C_8: 78 ± 10; C_1,C_9: 134 ± 35; C_1,C_{10}: 339 ± 50; and $C_1,ClCH_2CH_2$: 11.8 ± 0.7. All induced qualitatively similar cholinergic effects. No delayed effects occurred except for the C_1C_{10} ester (1 of 13). Delayed effects were found following supralethal doses (2 X LD50 plus atropine) with impure preparations of C_1,C_3, C_1,C_4, C_1,C_8, C_1,C_{10}, esters and the $C_1ClCH_2CH_2$ ester. The *bis* content of these ranged from 0.6 to 4.0%; a highly purified C_1,C_8 preparation, *bis* < 0.1%, did not cause delayed effects, *bis* n-alkyl substituted compounds had LD50 values of C_2: 3.0 ± 0.6; C_3: 9.4 ± 3.2; C_4: 13.7 ± 2.3; C_5: 25.7 ± 1.7; C_6: 82 ± 19; C_7: 677 ± 129; C_8: >3200; C_{10}: > 1800; and $ClCH_2CH_2$: 41.5 ± 5.4 mg/kg. Cholinergic effects were prominent in the C_3 through C_7 esters and the chloroethyl compound. Delayed paralytic effects occurred in all of the *bis* C_3-C_{10} and *bis* $ClCH_2CH_2$ chemicals at less than lethal levels. The C_2 analog induced the effect at lethal levels. The contribution of *bis* impurities (that can occur in the synthesis of the mixed esters) was tested with the C_1,C_8 and *bis* C_8 pair. Using similar (po) and dissimilar routes (po, im) of varying amounts of the esters indicated that the *bis* may be responsible for the effects found in the hen with impure preparations of the mixed esters. (Author abstract by permission) (Abstract No. 156)

74-2729. Kirkland, V. L.; Albert, J. R.; Van Kampen, K. (Shell Develop. Co., Modesto, CA). **Studies on dichlorvos-induced intestinal enteritis in the dog.** *Toxicol. Appl. Pharmacol. 29(1): 136; 1974.*

During a study of the acute oral lethality of technical dichlorvos in the dog, a consistent finding in succumbing animals was a marked inflammation of the mucosal surface of the intestine. The severity and extent of involvement ranged from a moderate to severe hyperemia over the proximal third of the duodenum, the principal area of involvement, to a severe hyperemia throughout the intestinal tract and colon. Consistent histopathological changes were found in affected animals. A cholinergic mechanism was postulated for the intestinal hyperemic effects of dichlorvos, and studies to substantiate this are the subject of this report. Anesthetized dogs were prepared for respiratory and vascular monitoring and cholinesterase determinations. Drugs were administered po except as noted. Necropsy centered on the digestive tract. With technical dichlorvos, the hyperemic effect was marked and consistent at 25 mg/kg, less marked and variable at 10 mg/kg (the minimal lethal dose in intact dogs) and absent at 3.2 mg/kg. Using 20% formulated dichlorvos (Task Dog Anthelmintic) the effect was mild and variable at 99 mg a.i./kg and absent at 33 mg a.i./kg, the therapeutic dose. Physostigmine, 40 mg/kg, elicited effects comparable to 25 mg/kg of technical dichlorvos. Cardiorespiratory responses following either technical or formulated dichlorvos or physostigmine were typical. The effects, except ChE inhibition, of both drugs were blocked by atropine (i.v.) but not by hexamethonium (i.v.). The dose-effect relationships (incidence and severity) of the hyperemic response indicate a close relationship to the lethality curve established in the intact animal. Histopathologically, the appearance of the affected portions of intestine was comparable to that in intact dogs. The intestinal lesion in dogs may be the result of local ischemia, as mesenteric arterial blood flow, measured in some dogs, was reduced in dichlorvos-treated animals showing the lesion. (Author abstract by permission) (Abstract No. 157)

74-2730. Lu, F. C. (World Health Organ., Geneva, Switzerland). **Needs of the WHO expert committee on**

pesticide residues for toxicological data. *Toxicol. Appl. Pharmacol. 29(1): 137; 1974.*

In 1961, the World Health Organization convened a joint meeting of its Expert Committee on Pesticide Residues with the FAO (Food and Agriculture Organization of the United Nations) Panel of Experts on the Use of Pesticides in Agriculture. The experts recommended that studies be undertaken to evaluate the hazards to the consumer on the basis of toxicological and other pertinent data on those pesticides which are known to leave residues in food. The WHO Expert Committee has met jointly with the FAO working Party of Experts on Pesticide Residues annually since 1966. Their tasks are to review the relevant data and establish, where possible, acceptable daily intakes of the pesticide residues for man, and to propose pesticide residue limits (e.g. tolerances) and methods of analysis for their determination. The recommendations are summarized in their reports, which are transmitted to governmental authorities as well as the Joint FAO/WHO Codex Alimentarius Commission as a basis for elaborating international limits of residues of pesticides. The Commission is an intergovernmental body and has at present a membership of 100 countries. Before each meeting, WHO collects data from all sources including the manufacturers. This procedure has in general proved satisfactory in acquiring the needed information. However, where no single manufacturer has an exclusive commercial interest in a product, there is then no economic incentive to generate the required data. Some pesticides in this category are effective in the control of pests in agriculture and inexpensive. They merit due consideration. It is hoped that members of the Society of Toxicology might be interested in providing the required information on such pesticides. (Author abstract by permission) (Abstract No. 158)

74-2731. Hayes, W. J., Jr. (Center in Toxicology, Dept. of Biochem., Vanderbilt Univ., Nashville, TN). **Distribution of dieldrin following a single oral dose.** *Toxicol. Appl. Pharmacol. 29(1): 143-144; 1974.*

Two groups of investigators have used the classical model for the distribution of thiopental following i.v. injection to predict the distribution of dieldrin following accidental ingestion. They concluded that the concentration of dieldrin in the brain is reduced first by redistribution to muscle and only later reduced by redistribution to fat. The model as originally designed for thiopental had been evaluated by analysis of samples from persons undergoing surgery under thiopental anesthesia. Since it is not appropriate to give large doses of dieldrin to people or to collect samples of muscle and various vital organs from them, the distribution of dieldrin was studied in rats. Dieldrin dissolved in corn oil was administered to these animals by stomach tube. The highest concentration of dieldrin in the brain was reached in 4 hr, and the concentration decreased gradually thereafter. The concentration in muscle remained essentially steady during the interval from 4 to 48 hr. There was no peak for muscle that could be interpreted as replacing a peak for brain. The concentration of dieldrin in fat was already slightly higher than that in the brain at 1 hr, very much higher at 4 hr when the concentration in the brain was maximal, and the concentration in the fat continued to increase during the first 24 hr. Either on the basis of concentration or on the basis of the total amount in each organ, no reason was found to assign any special importance to muscle as a sink into which dieldrin is redistributed from the brain. The fat appears to be far more important in this regard. The results indicate the danger of applying a mathematical model to a new situation without checking the results experimentally. (Author abstract by permission) (Abstract No. 173)

74-2732. Agarwal, H. C.; Gupta, B. (Dept. of Zool., Univ. of Delhi, Delhi-7, India). **Distribution and metabolism of DDT in the catfish *Heteropneustes fossilis* in relation to the signs of poisoning.** *Toxicol. Appl. Pharmacol. 29(1): 204-209; 1974.* (22 references)

Adult male catfish, *Heteropneustes fossilis* (Bloch), were given a lethal dose of 800 mg DDT/kg as an i.m. injection of 10% *p,p'*-DDT in peanut oil (w/v) in the caudal region. The metabolites of DDT in various tissues were studied 24 hr after treatment. For DDT distribution studies, the treated animals were divided into 6 categories according to signs of poisoning: (1) no signs, (2) hyperexcitation, (3) tremors, (4) convulsions, (5) death, and (6) recovery. The concentration of DDT was determined in brain, spinal cord, liver, kidney and fat. Adequate replicates and controls were used in each case. *p,p'*-DDE was the only metabolite detected. The major proportion of DDE (10%) was found in the kidney, while liver and fat bodies contained slightly lesser amounts of DDE. The remainder was unchanged DDT. The concentration of DDT in the tissues increased with time and the severity of poisoning. The brain and spinal cord contained the lowest concentration of DDT, starting with 7.1 and 9.8 ppm when the fish showed no signs. The DDT content gradually rose to 50.5 and 58.7 ppm when the fish were dead, and declined to 9.1 and 19.0 ppm in fish which recovered completely. In fat, the DDT content continued to increase steadily and was maximal in fish which had recovered. The results indicate that signs of poisoning in the catfish were directly related to the concentration of DDT in the brain and spinal cord. The concentrations of DDT in brain and spinal cord of the catfish soon after death were similar to those found in some other vertebrates, e.g., rats, mice and a few species of birds, under identical circumstances. (Author abstract by permission)

74-2733. Vos, J. G.; Moore, J. A.; Zinkl, J. G. (Nat. Inst. of Environ. Health Sci., Research Triangle Park, NC 27709). **Toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin**

(TCDD) in C57Bl/6 mice. *Toxicol. Appl. Pharmacol. 29(1): 229-241; 1974.* (20 references)

Three-month-old male C57B/6 mice were given single oral doses of 0, 100, 150, or 200 μg/kg. In mice that died, depletion of the thymus and spleen were consistently found and edema and terminal hemorrhages occurred frequently. In a second experiment, 4-month-old male mice were dosed po with 0, 0.2, 1.0, 5.0 or 25 μg/kg, once a week for 2 or 6 weeks. Some deaths and growth retardation occurred in the 25 μg/kg dose group. Significantly increased liver and decreased thymus weights were found in the 1, 5 and 25 μg/kg dose groups. Total neutrophils were increased significantly, whereas hemoglobin values and mean corpuscular hemoglobin concentrations were decreased significantly after 6 doses of 25 μg/kg. Total serum protein and α-, β-, and γ-globulins were significantly decreased. TCDD was porphyrogenic. The hepatic porphyria was probably associated with liver damage. Degenerative and necrotic changes in the liver were essentially centrilobular and were accompanied by cellular infiltrates and ceroid pigment deposition. Proliferation of bile duct and bile duct epithelial cells occurred. Lipid accumulation was centrilobulary localized in the mice receiving 0.2 μg/kg, was more pronounced in the mice of the intermediate dose levels, and involved hepatocytes throughout the lobule in the 25 μg/kg dose group. (Author abstract by permission)

74-2734. Guarino, A. M.; Pritchard, J. B.; Anderson, J. B.; Rall, D. P. (Lab. of Toxicol., Nat. Cancer Inst., Nat. Inst. of Health, Bethesda, MD 20014). **Tissue distribution of ^{14}C DDT in the lobster after administration via intravascular or oral routes or after exposure from ambient sea water.** *Toxicol. Appl. Pharmacol. 29(1): 277-288; 1974.* (11 references)

A pharmacokinetic approach to studying the fate and distribution of [^{14}C]DDT was employed using the lobster, a species of obvious economic importance. The radioactive pesticide was administered by 3 different routes; intravascular, oral and by exposure from the ambient water. After intravascular administration there was very rapid removal of [^{14}C]DDT from the plasma accompanied by a strikingly persistent increase in the amount of radioactivity in the hepatopancreas. Most (> 90%) of the radioactivity in this organ was shown by TLC to be the parent pesticide. Seven days after injection of [^{14}C]DDT approximately 90% of the administered radioactivity was found in the hepatopancreas and the concentrations in this organ decreased with a $t_{1/2}$ of 46 days. One month after treatment with 0.1 mg/kg of [^{14}C]DDT, the only other organs which contained more than 1% of the administered dose were egg masses and muscle. When the pesticide was administered to the lobster from ambient water or from food, the hepatopancreatic compartment again dominated, with more than 90% of the absorbed dose occurring in the organ 7 days after treatment. Studies conducted of residue levels in untreated lobsters indicated that the egg masses contained the largest concentration of total DDT metabolites (1 ppm). The hepatopancreas contained about 0.4 ppm while the carcass (muscle) contained about 0.1 ppm. These distribution studies suggest that while the lobster may protect itself from DDT toxicity by sequestering the pesticide in the hepatopancreas and in egg masses, bioconcentration in these tissue could be hazardous to species consuming these parts of the lobster. (Author abstract by permission)

See also 74-2550 74-2744

74-2735. Suzuki, K.; Nagayoshi, H.; Kashiwa, T. (Agr. Chem. Inspection Sta., Min. of Agr., and Forestry, Kodaira, Tokyo, Japan). **The systematic separation and identification of pesticides in the second and third division.** *Agr. Biol. Chem. 38(8): 1433-1442; 1974.* (6 references)

The systematic identification and determination of many kinds of pesticides were attempted by a combination of column, thin-layer and gas chromatography. Twenty-one pesticides in the second division e.g., α-, β-, γ-, δ-BHC, trifluralin, CPA, nitrofen, endrin, dieldrin, dicofol, etc. were separated from 15 pesticides in the third division, e.g., dichlone, EPN, anilazine, chlorpropylate, chlorpropham, folpet, barban etc., and pesticides in the third division were also separated from those in the fourth division, e.g., trietazine, prometryne, propazine, atrazine, BPMC, carbaryl etc. by column chromatography. Furthermore, these pesticides in the second and third divisions were separated from each other and determined by gas chromatography with ECD, FTD, and FID, after division into 4 groups by TLC. Most of these pesticides were more than 90% recovered through the whole procedure. (Author abstract by permission)

74-2736. Thomas, T. C.; Seiber, J. N. (Dept. Environ. Toxicol., Univ. California, Davis, CA 95616). **Chromosorb 102, an efficient medium for trapping pesticides from air.** *Bull. Environ. Contam. Toxicol. 12(1): 17-25; 1974.* (19 references)

Chromosorb 102 (60/80 mesh), a crosslinked polystyrene resin having a surface area of 300-400 m^2/g, was successfully used as an adsorbent for pesticide vapor collection. Collection efficiencies of the adsorbent for trifluralin, lindane, Kelthane (dicofol), dieldrin, *o,p'*-DDT, methoxychlor, parathion, diazinon, malathion, and Dursban (chlorpyrifos) were betwen 88 and 105% recovery, determined at vapor concentrations of approximately 5 ng/m^3 to 25 $\mu g/m^3$. The first 4 g of adsorbent in the upstream collection tube trapped essentially all the pesticide vapor. Thus, little or no loss due to incomplete trapping, revolatilization, or incomplete extraction occurred. Absence of significant chemical degradation was inferred from close examination of minor peaks in gas chromatograms.

74-2737. Dhaliwal, G. S. (Dept. Agr. Eng., Punjab Agr. Univ., Ludhiana, India). **Recent advances in the methodology of phosphine analysis.** *Bull. Grain Technol. 11(3-4): 214-219; 1973.* (16 references)

This paper reviews recent developments in the methodology of determining phosphine and its oxidation products in fumigated commodities and phosphine in air. Various colorimetric methods include oxidizing phosphine to phosphate and measuring the intensity of the blue color at 858 nm. Other authors claim greater sensitivity, adaptability and specificity for a method in which samples of air are drawn through a lead acetate plug into flasks containing silver diethyldithiocarbamate/pyridine, then measuring optical density at 465 nm. Titration methods used suffer no interference from hydrogen sulfide, hydrogen cyanide, sulfur dioxide or arsine present in concentrations one-seventh that of phosphine. In these titration methods, phosphine is reacted with mercuric chloride to form free HCl, which is then titrated with 0.1 *N* KOH or NaOH. A rapid GLC method has been used which can be carried out without interferences from ammonia and carbon dioxide, thus increasing the sensitivity of the determination. Radiolabeling techniques have been used to measure non-gaseous residue. Non-volatile phosphorus residues in ultra-pure filter paper after phosphine fumigation have been measured by neutron activation analysis.

74-2738. Anderson, B. S. (Qual. Contr. Lab., FMC Canada, Ltd., Burlington, Ontario, Canada). **Infrared analysis of pesticides.** *Can. J. Spectrosc. 19(2): 37-39; 1974.* (3 references)

A quality control laboratory analyzed, using infrared spectroscopy, more than 30 pesticides on the market to determine that they satisfactorily met the label guarantee. Four different extraction procedures were used depending on whether or not the active ingredient in liquid and soil formulations could be extracted (or diluted) with the best I.R. solvent or whether the extracting solvent had to be removed before using the I.R. solvent. The I.R. spectra were recorded on a spectrometer using 0.2 or 0.5 mm KBr liquid cells. An equation derived from Beer's law was used for calculating the percentage of active pesticide ingredient using peak heights and the base-line method. Standards were run after every twelfth sample or before rerunning a suspicious sample (i.e., one which was not within the guarantee). Procedures involved were straightforward and rapid with standardized volumes and aliquots.

74-2739. Smith, R. L. (Dept. Pathol., Chase Farm Hosp., Enfield, Middlesex, England). **The estimation of serum cholinesterase in the presence of anticholinesterase insecticides.** *Clin. Chim. Acta 52(3): 315-319; 1974.* (12 references)

Six different methods were used to determine the levels of serum cholinesterase in the presence of five anticholinesterase insecticides: disulfoton, dichlorvos, carbaryl, methiocarb, and isolan. Inhibition of cholinesterase activity was demonstrated in every case, but four of the methods underestimated the degree of inhibition. The concentration of each insecticide needed to reduce the enzyme activity to between 6 and 14% of the uninhibited value varied considerably, as did the period of incubation at room temperature necessary to produce this effect; isolan was the most powerful anticholinesterase tested. Methods using high serum dilutions, high temperatures, and high substrate concen-

trations produced the greatest degree of enzyme reactivation, while short incubation periods and low temperature gave lower degrees of reactivation. The degree of reactivation was greater with the carbamates than with the organophosphorus insecticides. When serum samples to which four of the five insecticides had been added were left at room temperature for 24 hours, the cholinesterase activity recovered almost completely. This did not occur if the samples were stored at -15°C. The best methods for the estimation of serum cholinesterase in the presence of anticholinesterase insecticides involve the use of: benzoyl choline as the substrate, 0.05 m*M* as the substrate concentration, 1 in 200 as the serum dilution, a temperature of 26°C, and an incubation time of 3 minutes; or acetyl thiocholine as the substrate, a substrate concentration of 5 m*M*, serum diluted to 1 in 156, a temperature of 25°C, and an incubation time of 1 minute.

74-2740. Plashko, B. E. (North Dakota State Univ., Grand Forks, ND). **Mass spectrometry of suspected *s*-triazine herbicide metabolites.** *Diss. Abstr. Int. 35(1): 144B-145B; 1974.*

The mass spectral fragmentations of 41 *s*-triazines and various silyl derivatives are examined in detail; fragmentation schemes are presented which make it possible to determine which mass spectral peaks might occur when any given *s*-triazine is analyzed by mass spectrometry. The utility of the generalized schemes is then illustrated by their aid in the structural assignment of a metabolite of the herbicide atrazine (2-chloro-4-ethylamino-6-isopropylamino-*s*-triazine) which had the possibility of being one of two isomeric compounds, namely, *N*(3-hydroxy-5-ethylamino-2,4,6-triazinyl)-alanine or (3-hydroxy-5-isopropylamino-2,4,6-triazinyl)-glycine. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 73-31,192.)

74-2741. Ripley, B. D.; Hall, J. A.; Chau, A. S. Y. (Prov. Pestic. Residue Test. Lab., Ontario Min. Agr. Food., Univ. Guelph, Guelph, Ontario, Canada). **Determination of fenitrothion, phosphamidon and dimethoate in natural water.** *Environ. Lett. 7(2): 97-118; 1974.* (16 references)

Fenitrothion, dimethoate, and phosphamidon have been used in Canada against defoliating insects since the ban on DDT. A method is given for the separation and determination of residues in distilled water (pH 7.6 - 8.4), Great Lakes type water (8.2), and agricultural runoff water (pH 8.7). It was impossible to separate fenitrothion from phosphamidon due to similar retention times on GLC columns. They were, therefore, separated by serial extraction of the aqueous sample with hexane and chloroform. The effect of storage for 16 and 23 days in distilled and natural water is given. Percent recovery of fenitrothion (at 10 ppb) after 16 days in distilled water was 91% and 84% at 23 days; for phosphamidon (50 ppb) corresponding figures were 78 and 75% and for dimethoate (10 ppb) 96 and 93%.

74-2742. Mirkhaitov, T.; Ikramov, L. T. (Tashkent Inst. Pharmaceutics, Tashkent, USSR). **Opredeleniye fozalona i ftalofosa pri sudebno-khimicheskom analize biologicheskogo materiala. [Determination of the phosalone and phthalophos in the forensic-chemical analysis of biological materials.]** *Farmatsiya 22(6): 64-67; 1973.* (5 references) (Russian)

Methods are described for the detection and quantitative determination of phosalone and phthalophos (phosmet) in biological materials for forensic analyses. Extraction from the homogenized samples is best done by means of ether at pH 5. The rates of recovery after three subsequent extractions are 41% for phthalophos and 48% for phosalone. For qualitative determination the samples are transferred in benzene and cleaned on alumina and silica gel layer, after which identification is possible on KSK silica gel layer by means of bromphenol blue with acetone and silver nitrate, and of acetic acid. For quantitative determination, the dehydrated samples are mineralized by means of concentrated nitric and sulfuric acids, after which phthalophos is determined by means of alcoholic saturated solution of silver nitrate, mercury dibromide, or mercury diiodide. Phosalone is determined by means of alcoholic solution of silver nitrate, mercury dichloride, or mercury diiodide. The limit of the chromatographic detection amounts to 20 μg per 100 g for phosalone and to 30 μg per 100 g for phthalophos. The sensitivity of the quantitative determination is 1 mg for phosalone and 2 mg for phthalophos in 100 g biological material.

74-2743. Vergeychik, T. Kh.; Grayaznova, E. O. (Pyatigorsk Inst. Pharmaceutics, Pyatigorsk, USSR). **Viznachennya 2,4-dikhlorfenoksitovoy (2,4-D) kisloti v biologichnom materialu. [Determination of 2,4-dichlorophenoxyacetic acid in biological material.]** *Farm. Zh. (Kiev) 24(6): 54-59; 1969.* (22 references) (Ukrainian)

A procedure for the detection and quantitative determination of 2,4-D in biological materials is described; the dynamics of 2,4-D was studied in biological materials for forensic analyses. The 2,4-D is extracted from biological materials by 1% aqueous solution of ammonia, applying three-fold extraction for 8 hr in the presence of sodium chloride. Paper chromatography is recommended for both the clean-up and the identification of 2,4-D. A 30:15:5 ratio of isoamyl alcohol, concentrated ammonia, and water is used as a solvent system for detection, using 0.1% aqueous solution of rhodamine C or 0.4% alcoholic solution of bromcresol purple for visualization. Quantitative determination is possible by spectrophotometric method at 283 nm. The 2,4-D residue level in biological materials treated with this pesticide was largely the same 8 and 12

hr after treatment. In liver samples to which 10 mg 2,4-D was added per 100 g sample, the percentages of 2,4-D recovered after 5, 10, 20, 30, 60, and 90 days were 57.41%, 56.7%, 44.2%, 29.9%, 17.6%, and 8.02%, respectively.

74-2744. Bhattacharyya, J.; Bhattacharyya, K.; Sengupta, P. K.; Ganguly, S. K. (State Forensic Sci. Lab., Calcutta, India). **Detection and estimation of tricresyl phosphate in mustard oil.** *Forensic Sci. 3(3): 263-270; 1974.* (10 references)

Mustard oil contaminated with tri-*o*-cresyl phosphate was responsible for a peculiar form of paralysis of many people in the summer of 1972 in a suburb of Calcutta. The affected persons suffered stomach pains, nausea, and usually vomiting and diarrhea followed in a week or so by muscle soreness, then numbness of the feet and toes. Elemental analysis indicated the presence of phosphorus, an element foreign to pure mustard oil. Phosphate was detected by the appearance of a blue color after saponification of the sample, extraction, and reaction with molybdic acid solution, sodium sulfite, and hydroquinone. A blue color with Folin-Ciocalteau reagent indicated a phenolic compound. Ortho-cresol was identified by TLC of the sample with control samples of phenol and the three isomeric cresols. Tri-*o*-cresyl phosphate was detected by TLC and UV spectroscopy. Total phosphorus and *o*-cresol were determined colorimetrically. The composition of the adulterated mustard oil was confirmed by preparing a mixture of tri-*o*-cresyl phosphate and pure mustard oil to give the same refractive index as that of the seized oil and measuring and comparing absorbance values of this prepared mixture and the sample at 510 to 725 nm.

74-2745. Freitag, K. D.; Bock, R. (Inst. fuer Anorganische Chemie und Kernchemie der Johannes Gutenberg-Univ., Mainz, Germany). **Analyse von Gemischen aus Tri-, Di- and Monophenylzinnverbindungen und anorganischem Zinn (IV). [Analysis of mixtures containing tri-, di-, and monophenyl tin compounds and inorganic tin.]** *Fresenius' Z. Anal. Chem. 270(5): 337-346; 1974.* (29 references) (German)

Triphenyl tin compounds are extracted as $(C_6H_5)_3SnOSn(C_6H_5)_3$ by $CHCl_3$ or CH_2Cl_2 from aqueous solution of pH 8.5. Diphenyl tin compounds are separated by solvent extraction with PAN/$CHCl_3$, diphenylcarbazone/$CHCl_3$, dithizone/$CHCl_3$, α-benzoinoxime/$CHCl_3$, PAR/i-Pentanol etc. Monophenyl tin compounds are extracted by Tropolone/$CHCl_3$, and inorganic tin(IV) is separated by diethyl dithiocarbamate/$CHCl_3$ from acidified solution of pH 4. Several thin-layer chromatographic methods are given. The separated compounds are determined by radiometric or new photometric methods. (Author abstract by permission)

74-2746. Schuetz, H.; Schindler, A. (Inst. fuer Rechtsmed. im Zentrum fuer Oekol. der Justus Liebig-Univ., Giessen, Germany). **Mikrochemischer Nachweis und duennschicht-chromatographische Trennung von 16 Nitroverbindungen aus der Klasse der Pesticide. [Microchemical detection and separation of sixteen nitropesticides by thin layer chromatography.]** *Fresenius' Z. Anal. Chem. 270(5): 356-359; 1974.* (29 references) (German)

An analysis method for the detection and separation of sixteen nitro-pesticides is described. After thin-layer chromatographic separation, the nitro-compounds are converted to primary aromatic amines which are detected by diazotization and subsequent coupling with Bratton-Marshall reagent. The photometric measuring of the azo-dye, obtained by elution, permits quantitative determination. (Author abstract by permission)

74-2747. Marich, Yu. V. (Chernigov District Sanit. Epidemiol. Station, Chernigov, USSR). **Opredeleniye dinila v atmosfernom vozdukhe. [Determination of dinil in the air.]** *Gig. Sanit. 38(12): 103-105; 1973.* (3 references) (Russian)

A colorimetric method for the determination of dinil in the air is described. Air is sampled through an absorber containing nitrating mixture (potassium nitrate with concentrated sulfuric acid). Then, benzene homologs are oxidized by means of potassium dichromate, after which extraction is done with toluene, and the extract is cleaned up with 1% sodium carbonate solution. The extract, containing nitro derivatives of dinil, and meta-dinitrobenzene, is combined with acetone, acetic acid, and 1% sodium sulfate solution for the obtainment of a colored solution suitable for colorimetric determination of dinil.

74-2748. Radovici, E.; Ichim, A. (Inst. Ig. San. Publ., Bucharest, Rumania). **Analiza si separarea substantelor insecticide "pp'-DDT" si "γ-HCH" prin metoda cromatografiei in strat subtire. [Analysis and separation of *p,p'*-DDT and γ-BHC by thin-layer chromatography.]** *Igiena 21(10): 619-624; 1972.* (6 references) (Rumanian)

Problems in the separation and identification of organochlorine insecticides are discussed on the basis of *p,p'*-DDT and γ-BHC analysis. Silica gel thin-layer chromatoplates, spotted with 5-50 μg of *p,p'*-DDT and/or γ-BHC and developed in benzene, were sprayed with several color reagents; the colors developed and the *Rf* values were examined. A distinct grey color develops when the *p,p'*-DDT spot is sprayed with silver nitrate, while aromatic amines, diphenylamine and paraphenylenediamine, give a violet color with γ-BHC and brownish shades with *p,p'*-DDT. The *Rf* of *p,p'*-DDT using 1% diphenylamine in acetone was 0.763-0.764; the *Rf* of γ-BHC, 0.670-0.673. The *Rf* found with *p*-phenylenediamine was 0.720 for *p,p'*-DDT and 0.652 for

γ-BHC. The *Rf* values for *p,p'*-DDT using a 0.5% silver nitrate solution in acetone as color reagent were 0.718 when 12.5 μg of *p,p'*-DDT was used and 0.725 for 25 μg. The detection limit is on the order of 1 μg for each of these compounds.

74-2749. Vyas, S. C.; Tripathi, R. K. (Dept. Plant Pathol., J.N.K.V.V., Jabalpur-4, India). **A rapid separation and detection of dithiocarbamate fungicides by thin layer chromatography.** *Indian Phytopathol. 25(4): 513-516; 1972.* (5 references)

Thin layer plates were coated with silica gel, dried in air for 5 minutes, and dried at 50° for 5 minutes. Standard acetone solutions of each fungicide were spotted onto the plates and placed in a chamber with 10 ml of solvent system. After the solvent ascended three fourths of the way up, the plates were removed, dried in air for 5 minutes, and the spots located in iodine vapor. For quantitative determinations of thiram the corresponding spots were dissolved in a minimum amount of chloroform, removed by aspiration, reacted with cuprous iodide, and determined colorimetrically by measuring absorbance at 440 nm. The solvent systems in which thiram, ziram, and zineb could be separated (because of differences in *Rf* values) were: acetone to separate all 3; acetone-*n*-propanol (1:1) for separating thiram from zineb and ziram; chloroform-*n*-hexane (1:3) for separating zineb from the 2 others; and petroleum ether-chlorform (9:1 or 9:4:0.6) for separating ziram from the other two. *Rf* values were the same whether applied to TLC plates alone or in combination.

74-2750. Weyer, L. G. (Hercules Res. Cent., Hercules, Inc., Wilmington, DE 19899). **Gas-liquid chromatographic method for the analysis of carbaryl insecticide formulations.** *J. Ass. Offic. Anal. Chem. 57(4): 778-780; 1974.* (13 references)

A gas-liquid chromatographic method has been developed for the direct analysis of Sevin (carbaryl, 1-naphthyl *N*-methylcarbamate) technical grade, Sevin 85, Sevin 80, and Sevin 50 formulations. The method consists of dissolving the sample in chloroform containing Thiodan endosulfan as an internal standard; an aliquot of the supernate is injected into a gas chromatograph with a flame ionization detector and a column packed with 3% SE-30 on 60-80 mesh Gas-Chrom Q. The method compares favorably in accuracy with older methods, is not subject to interferences, is rapid, and has automation possibilities. (Author abstract by permission)

74-2751. Collier, R. H.; Grimes, G. S. (Dept. Biochem., Purdue Univ., Lafayette, IN 47907). **Determination of chlorophenoxy acids in formulations by gas-liquid chromatography of their trimethylsilyl derivatives.** *J. Ass. Offic. Anal. Chem. 57(4): 781-784; 1974.* (5 references)

A rapid, precise, and specific method for the analysis of free acid and amine salt formulations of chlorophenoxy acids has been developed. Samples containing the amine salts are prepared by addition of dioxane and removal of the water/dioxane azeotrope by rotary evaporation. The trimethylsilyl esters are prepared by incubation of free acids or the above dry residues with *N,O*-bis(trimethylsilyl)acetamide. The esters are chromatographed on 5% SE-30 on 80—100 mesh Chromosorb W with column temperature programming, using pyrene as an internal standard. The method has undergone a ruggedness test which showed very little sensitivity to changes in many of the chromatographic and derivatization conditions. The method was compared to the official final action infrared method for 2,4-D amine salt formulations, 6.A15-6.A19, and to a modified infrared method using the C—Cl stretching band at 15.6 μm for measurement. The official method gave a relative standard deviation of 9%, while the modified infrared method and the gas chromatographic method gave relative standard deviations of 1.2 and 1.0%, respectively. The gas chromatographic method resulted in values not significantly different from those of the official method. With the modified infrared method, high results were obtained for some samples, presumably due to the presence of chlorine-containing compounds other than 2,4-D. Recovery of acids and amine salts for the gas chromatographic method is 100.5±1.0%. The method distinguishes between MCPA, MCPP, 2,4-D, 2,4-5-T, silvex, and 2,4-DB. (Author abstract by permission)

74-2752. Levi, I.; Nowicki, T. W. (Grain Res. Lab., Can. Grain Commission, Winnipeg, Manitoba, Canada R3C 3G9). **Rapid screening method for simultaneous determination of organochlorine and organophosphate pesticide residues in wheat by gas-liquid chromatography.** *J. Ass. Offic. Anal. Chem. 57(4): 924-929; 1974.* (18 references)

A previously reported gas chromatographic method for screening of organochlorine residues in wheat has been modified to permit rapid simultaneous screening for common organochlorine and organophosphate residues in wheat. Ground wheat is extracted by ball-milling with ethyl ether-hexane (3+97). The extract is divided into 2 equal portions. One half is used without cleanup for determination of organophosphates by flame photometric detection. The other half is cleaned up on Florisil prior to determination of organochlorines by electron capture detection. The mean average recovery of 9 organochlorines from wheat fortified at 0.50 ppm was 80%. Wheat analyzed immediately after treatment with 15 organophosphates showed an average mean recovery of 93%. After 8 weeks' storage, 9 of 15 organophosphates were recovered in excess of 60%, with an average mean recovery of 90% at the 1.00 ppm fortifica-

tion level. The average mean recovery for 9 organophosphates was 7% lower for extraction by ball-milling with ethyl ether-hexane than for Soxhlet extraction with methanol-chloroform (10+90). (Author abstract by permission).

74-2753. Laski, R. R. (Food Drug Admin., Buffalo, NY 14202). **Collaborative study of a method for organophosphorus pesticide residues in apples and green beans.** *J. Ass. Offic. Anal. Chem. 57(4): 930-933; 1974.* (3 references)

Ten laboratories took part in a collaborative study of a method for organophosphorus pesticide residues in apples and green beans. Six representative organophosphorus pesticides or oxidation products were determined in duplicate at a different level on each crop. The average recovery of the pesticides, using the gas chromatogaphic potassium chloride thermionic detection system, had the precision and accuracy expected for parathion, paraoxon, carbophenothion oxygen analog, carbophenothion, and EPN. Interference due to reagents made quantitation of dimethoate inaccurate. The average recovery (%) of the pesticides on apples and beans, respectively, was as follows: dimethoate 125.1 and 112.9; paraoxon 99.3 and 103.7; parathion 86.5 and 92.2; carbophenothion oxygen analog 96.7 and 100.1; carbophenothion 88.8 and 102.6; and EPN 90.8 and 98.3. A separate part of the study involved a comparison between the potassium chloride thermionic gas-liquid chromatographic detector and the phosphorus-specific flame photometric detector. A statistical analysis of the results obtained from 5 laboratories indicated that the 2 detection systems were equivalent in both precision and accuracy. (Author abstract by permission)

74-2754. Narayanaswami, K.; Moitra, B.; Kotangle, R. S.; Bami, H. L. (Central Forensic Sci. Lab., New Delhi, India). **Thin-layer chromatography in the detection of poisoning by pesticides.** *J. Chromatogr. 95(2): 181-188; 1974.* (29 references)

The relative efficiencies of various chromogenic reagents used in thin-layer chromatography (TLC) for the detection of commonly used pesticides in India have been evaluated. Combined diagnostic techniques using two sets of chromogenic reagents on a single TLC plate are suggested for the detection of certain organochlorine and organophosphorus pesticides. (Author abstract by permission)

74-2755. Lawrence, J. F.; Frei, R. W. (Food Res. Lab., Health Protect. Br., Tunney's Pasture, K1A OL2, Ottawa, Ontario, Canada). **Fluorimetric derivatization for pesticide residue analysis.** *J. Chromatogr. 98: 253-270; 1974.* (163 references)

Recent advances in fluorimetric analysis using derivatization techniques associated with TLC and high speed liquid chromatography (HSLC) have provided an important and varied basis for future work in pesticide residue determinations. Three factors which affect fluorescence are the structure of the molecule, the solvent in which it is dissolved, and the concentration. For residue determination, in situ scanning of TLC plates or HSLC offer more advantages than solution fluorescence measurements which must rely on sample blanks for a background fluorescence correction. Most fluorimetric analyses of pesticides require pre-treatment of the compounds to convert them to fluorescent species. These pretreatments may be hydrolysis, ligand-exchange reactions, exploitation of pH effects and polarity, heat treatment, condensation reactions. Fluorigenic labeling of various pesticide types (*N*-methylcarbamates, *N*-phenylcarbamates, urea compounds, organophosphates, *s*-triazines and hydroxybiphenyls) by reaction with dansyl chloride is being investigated. The use of NBD chloride (4-chloro-7-nitrobenz-2,1,3-oxadiazole) for fluorescence analysis of alkylamine-generating pesticides has recently been investigated. Fluorescamine reacts with primary amines to form fluorescent derivatives.

74-2756. Magos, L.; Jawad, A. M. (M.R.C. Toxicol. Unit, Med. Res. Counc. Lab., Woodmansterne Road, Carshalton, Surrey, England). **Method for screening barley and wheat samples for mercury.** *J. Sci. Food. Agr. 24(10): 1305-1309; 1973.* (3 references)

During the outbreak of methylmercury poisoning in Iraq in 1972, due to misuse of seed wheat treated with methylmercury fungicide, it was necessary to develop a rapid screening method which did not require elaborate instruments, special skill, and care. A previously developed atomic absorption method was sucessfully used during the emergency. One ml of 1% cysteine was added to 1 g of crushed grain, then 20 ml of 1% saline, 10 ml of 16 *N* H_2SO_4 and 1 ml of $SnCl_2$-$CdCl_2$ reagent. This released all the mercury as atomic mercury. After a flow of approximately 2.5 l/min was started on the air pump to move the atomic mercury through the gas cell of a mercury vapor lamp, 20 ml of 45% NaOH was added. Deflection on the scale of the mercury vapor meter was compared to standard additions to the same sample, and mercury contents were calculated. Approximately 60% of the mercury was released from crushed grain in this way, sufficient to separate contaminated from safe grain.

74-2757. Canters, G. W.; deBoer, E. (Dept. Phys. Chem., Univ. Nijmegen, The Netherlands). **Alkali N.M.R. experiments on the radical ion pairs of biphenyl and fluorenone. Part I. Analysis of N.M.R. shifts.** *Mol. Phys. 26(5): 1185-1198; 1973.* (22 references)

NMR experiments on the alkali salts of biphenyl and fluorenone in solutions of various ethers are presented. Signals of the cations of ^{6}Li, ^{7}Li, ^{23}Na, ^{39}K,

^{85}Rb, ^{87}Rb, and ^{133}Cs were observed, and the variation of their shifts with solvents and temperature were analyzed. Sodium biphenyl in tetrahydropyran and in 2-methyltetrahydrofuran and rubidium biphenyl in dimethoxyethane show a monotonous increase in hyperfine splitting constant (hfsc) with temperature. The Fermi contact interaction probably plays a dominant role in determining the shift. For all other alkali-biphenyl systems, at high temperatures, Fermi contact interaction dominates hfsc, while at lower temperatures, apparently because the average solvation of the cation increases, the chemical shift is dominated by $\Delta\sigma(\Delta\sigma \equiv \sigma IP\text{-}\sigma AQ$ where σIP and σAQ are screening constants representing the chemical shielding of the nucleus in the ion pair and in the hydrated ion respectively.) For the alkali-biphenyl system, solvating power of the solvents used increases in the order of tetrahydropyran < 2-methyltetrahydrofuran < tetrahydrofuran < dimethoxyethane < diglyme < triglyme < tetraglyme. Alkali-fluorenone salts are not very temperature dependent, probably due to incomplete solvation because of strong radical attraction.

74-2758. Himel, C. M. (Dept. Entomol., Univ. Georgia, Athens, GA 30601). **Fluorescent probes in the detection of insecticides in water.** *Nat. Tech. Inform. Serv. PB No. 221336/1, 1973, 41 pp.* (15 references)

Insecticides in water which compete with fluorescent probe molecules for the active site on cholinesterase enzymes will quench the fluorescence of the probe-enzyme complex. The change in spectral response can be the basis of a new method for determining insecticides in water. Objectives of the present research included the synthesis of active-site-directed fluorescent equilibrium inhibition of cholinesterases. One promising probe molecule synthesized was 5-dimethylaminonaphthalene-1-sulfonamido-*N,N*-dimethyl-*n*-propylamine (TA). With TA Dursban (chlorpyrifos), Thiodan (endosulfan), and other insecticides were detected in the range of 10^{-7} *M*. Other compounds which competed for the probe-enzyme complex using TA as the probe molecule were naled, diazinon, phorate, paraoxon, TEPP, guthion (azinphosmethyl), ethion, malathion, DDT, heptachlor, dieldrin, DDE, and eserine. It is estimated that with an optimum probe molecule, sensitivity will be in the range of 10^{-9} *M*.

74-2759. Yamane, T. (Chemical Laboratory, Nihon Noyaku Co. Ltd., Osaka, Japan). **[Derivatization on pesticides for gas chromatographic analysis of pesticide residues.]** *Noyaku (Pesticides) 21(3): 50-52; 1974.* (33 references) (Japanese)

Gas chromatography has come to be widely used for determining pesticide residues because of the method's high sensitivity and differentiation capacity. However, in some cases the pesticide itself is not volatile or contains no suitable element for gas chromatographic detection. In such cases chemical changes are inserted into the analytical procedure to make the derivatives suitable for gas chromatography. Representative chemical changes used in such cases are discussed: e.g., oxidation of disulfoton; reduction of paraquat dichloride; methylation of halophenols; thermal degradation of trichlorfon; hydrolysis, trichloro- or trifluoroacetylation of hydrolysis products of carbamates; nitrophenylation of phenols; and halogenation, phosphorylation, and silylation of various compounds.

74-2760. Fitak, B.; Zieba, B.; Spirydonow, E. (Dept. Food Chem., Inst. Biopharm., Acad. Med., Warsaw, Poland). **Wykrywanie dipterekSu obok czesciowo rozlozonego preparatu DDVP metoda chromatografii bibulowej wstepujacej, krazkowej i dwukierunkowej. [Detection of dipterex in the presence of partially decomposed DDVP by ascending, disc, and two-dimensional paper chromatography.]** *Rocz. Panstw. Zakl. Hig. 25(2): 153-158; 1974.* (8 references) (Polish)

The methods of ascending, disc, and two-dimensional paper chromatography were used for simultaneously detecting dipterex (trichlorfon) as well as partially decomposed DDVP (dichlorvos). Whatman No. 1 and No. 52 filter papers were used together with the following solvent systems: *n*-butanol-glacial acetic acid-water (4:2:1) and isopropanol-water (1:1). The time of development of the chromatograms was 4-5 hours for one-dimensional ascending chromatography and disc chromatography, and 2-2.5 hours for two-dimensional chromatography. Dipterex was detected with a solution of 3,5-dinitrobenzoic acid (1 g of acid in 40 ml of freshly prepared 5% $NaHCO_3$) after heating at 70° for 2 minutes. DDVP was detected with a 0.25% methanol solution of dimethyl yellow. The detection limit of dipterex was 5-10 μg while that of DDVP preparation was 200 μg. Using a long time of development of the chromatograms (about 20 hours) dipterex could be completely separated from DDVP, but this is not worthwhile, since the sensitivity of the method is then considerably decreased. Therefore, the methods described do not make it possible to separate the two compounds completely.

74-2761. Ten Noever de Brauw, M. C.; Van Ingen, C.; Koeman, J. H. (Central Inst. Nutrition Food Res. TNO, Zeist, The Netherlands). **Mirex in seals.** *Sci. Total Environ. 2(2): 196-198; 1973.* (2 references)

A computerized gas chromatography-mass spectrometry system was used to analyze a compound containing six chlorine atoms and with the characteristic mass number 270. The compound was found in extracts of seal (*Phoca vitulina*) blubber. The system used gives a total ion current chromatogram from which the mass chromatogram for the characteristic mass 270 and the mass spectrum at this location are obtained. The results indicated that the compound in question was

mirex: this was confirmed by comparison with a reference sample.

74-2762. Sekita, H.; Suzuki, T.; Takeda, M.; Tanabe, H. (Nat. Inst. Hyg. Sci., Tokyo, Japan). **[Studies on analysis of pesticide residues in foods (XV). Analytical method for carbamate insecticide residues in unpolished rice by gas chromatography with ECD.]** *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jap.) 15(4): 219-225; 1974.* (7 references) (Japanese)

To establish a method for simultaneously determining the nine methylcarbamate insecticides registered in Japan, gas chromatography (with ^{63}Ni-ECD) of the trifluoroacetyl derivatives, obtained by reacting the methylcarbamates with trifluoroacetyl anhydride, was studied. The conditions in the present study included: column with 5% XE-60, 1.5 m in length, column temp. 170°C, inlet and detector temperature 250°C, carrier gas N_2 at 0.6 kg/cm^2, detector sensitivity 10^2 MSΩ and range 16×10^{-2} V. Detection limits were 0.006-0.008 ng for 3-methylphenyl, 2-isopropylphenyl, and 2-*sec*-butylphenyl *N*-methylcarbamate (MTMC, MIPC, and Osbac respectively); 0.01-0.02 ng for 2-chlorophenyl, 3,4-dimethylphenyl, 2-isopropxyphenyl and 3,5-dimethylphenyl *N*-methylcarbamate (CPMC, meobal, propoxur, and maqbarl respectively); and 0.15 ng for carbaryl. The recovery of these carbamates added to unpolished rice powder using the present method ranged from 86% for 2-chlorophenyl *N*-methylcarbamate to 108% for carbaryl. For determining these carbamate residues in brown rice *n*-hexane/acetonitrile partitioning is recommended for removing fats, and column chromatography on alumina is recommended for removing co-existing organochlorine pesticides.

74-2763. Konyuhkov, A. F. (All-Union Inst. Exp. Vet., USSR). **Opredeleniye pestitsidov v kombikormakh. [Determination of pesticides in combination feeds.]** *Veterinariya (Moscow) 6: 101-102; 1974.* (Russian)

Thin-layer chromatographic methods are described for the quantitative determination of anthio (formothion) , dimethoate, trichlorfon, and DDVP (dichlorvos) in combination feeds. Following extraction with acetone, reextraction was performed by means of a mixture of water with chloroform. Anthio and dimethoate were visualized by means of ammonia-acetone solution of silver nitrate on a chromatographic plate previously treated with 20% sodium hydroxide solution. The sensitivity amounted to 0.2 mg/kg. Trichlorfon and DDVP were determined by means of a mixture of 2% resorcinol and 10% sodium carbonate at a ratio of 2:3. Then, the chromatographic plate was sprayed with 20% sodium hydroxide solution. The sensitivity for trichlorfon and DDVP amounted to 0.5-0.8 mg/kg in feeds containing jointly all four pesticides.

74-2764. Leshchev, V. V.; Smirnov, A. M.; Talanov, G. A. (All-Union Sci. Res. Inst. Vet. Hyg., USSR). **Opredeleniye fozalona v mede metodami tonkosloynoy i gazo-zhidkostnoy khromatografii. [Determination of phosalone in honey by thin-layer chromatography and gas-liquid chromatography.]** *Veterinariya 6: 106-107; 1974.* (Russian)

A thin-layer chromatographic and a gas-liquid chromatographic method for the quantitative determination of phosalone in honey are described. Phosalone is extracted by means of *n*-hexane, after which chromatographic separation is done on Silufol layer using 1:1 ratio of chloroform and acetone as solvent system. The spots are visualized by spraying the thin layer with 0.75% solution of 2,6-dibromo-*N*-quinone chloride-imide in chloroform with subsequent exposure to IR and UV light. At a recovery rate of 85% the sensitivity amounts to 0.2 mg/kg. After similar extraction and clean-up procedure, GLC determination is done by analyzing the residue in acetone in a gas chromatograph with thermionic detector. The sensitivity of the GLC method amounts to 0.2 ng in the sample.

74-2765. Wagner, R.; Hoyer, J. (Arbeitshygienische Untersuchungsstelle fuer die Landwirtschaft, Manschnow, DDR). **Zur Bestimmung der Arbeitsplatzkonzentrationen von Pflanzenschutzmitteln (PSM) in der Landwirtschaft. [Determination of working place concentrations of pesticides in agriculture.]** *Z. Gesamte Hyg. Ihre Grenzgeb. 20(3): 146-150; 1974.* (31 references) (German)

Sampling, extraction, and analytical procedures for the determination of workplace concentrations of organophosphorus and organochlorine pesticides are described. Ethylene glycol, dimethylformamide, ethanol, sodium hydroxide, and distilled water were suitable absorbents for air sampling through two-stage absorbers. The rates of absorption for methyl parathion, dimethoate, demephion, butonate, DDVP (dichlorvos), trichlorfon, DDT, BHC, dicofol, DNOC, and DNBP ranged from 79-99.8%, the concentrations of these substances in the air varying from 0.3 to 78 mg/m^3. The subsequent extraction and concentration of the samples were done by means of *n*-hexane or chloroform. Ethanol-absorbed samples did not require extraction. A semiquantitative enzymatic thin-layer chromatographic method with Silufol UV-254 ready-made plates was used for the determination of methyl parathion, dimethoate, butonate, trichlorfon, DDVP, and demephion. Dicofol, DDT, and BHC were determined by a semiquantitative thin-layer chromatographic method on Silufol UV-254 ready-made plates. Quantitative determination of DNOC and DNBP was possible by a photometric method after addition of 0.1 *N* sodium hydroxide.

74-2766. Pertsovskiy, A. L; Botvin'eva, A. M.; Prismotrov, Yu. A. (Belorussian Sci. Res. Inst. Sanit. Hyg.,

Minsk, USSR). **Gazokhromatograficheskoye opredeleniye ostatochnykh kolichestv gerbitsidov eptama i tillama v vode s primeneniyem plamenno-ionizationnogo detektora. [Gas-chromatographic determination of residual amounts of herbicides eptam and tillam in water by using a flame-ionization detector.]** *Zh. Anal. Khim. 29(1): 181-182; 1974.* (2 references) (Russian)

A gas-liquid chromatographic method is described for the detection and quantitative determination of eptam and tillam in water by means of a flame-ionization detector. Extraction and concentration of eptam and tillam residues is done with carbon tetrachloride added to the water sample at a ratio of 100:1. The rate of recovery for eptam and tillam by single-stage extraction is 91% and 95%, respectively. Chromaton N-AW treated with dimethyldichlorosiloxane as solid carrier, Luco oil MF (polymethylphenylsiloxane oil with 50% phenyl) as liquid phase, a column temperature of 120°C, and an evaporator temperature of 210°C are used for the gas-liquid chromatographhic determination. The sensitivity of the method is 0.002 mg/liter.

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